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The Steel Headframe at No. 9 Shaft, Republic Mine, Vulcan, Mich.

By Floyd L. Burr*

SYNOPSIS—Old wooden headframe demolished and new steel headframe constructed and shaft kept from operation only seven weeks. New 100-ft. headframe designed for sheaves in tandem instead of parallel as usual; for unusual structure stresses; and uncommon method of hoisting and balancing. Total weight of steel 142,000 lb.; that cost erected, $8400.

In the earlier days of the Lake Superior mining region, when timber was a plentiful local product, almost all mine structures above and below the surface were of wood. Many of these structures have given excellent service but have now reached a state of advanced decay and must be replaced. In making replacement, attention is now usually directed toward a more durable material than wood, and this is especially true when a headframe is under consideration. The structure described in this article was erected for the Republic Iron Co., which at the time of construction was the owner of the property. It was operated under the same general management as the Penn Iron Mining Co.'s mines at Vulcan. The Republic mine has since been transferred to the Cleveland Cliffs Iron Co. No. 9 shaft of the Republic Mine is a rectangular timber-lined vertical shaft 6 ft. by 17 ft. 4 in. inside the timbers, having three compartments comprising a cageway at the north end, a skipway at the south end and a middle compartment used for pipeway, ladderway and balanceways—a very common type of shaft in this district.

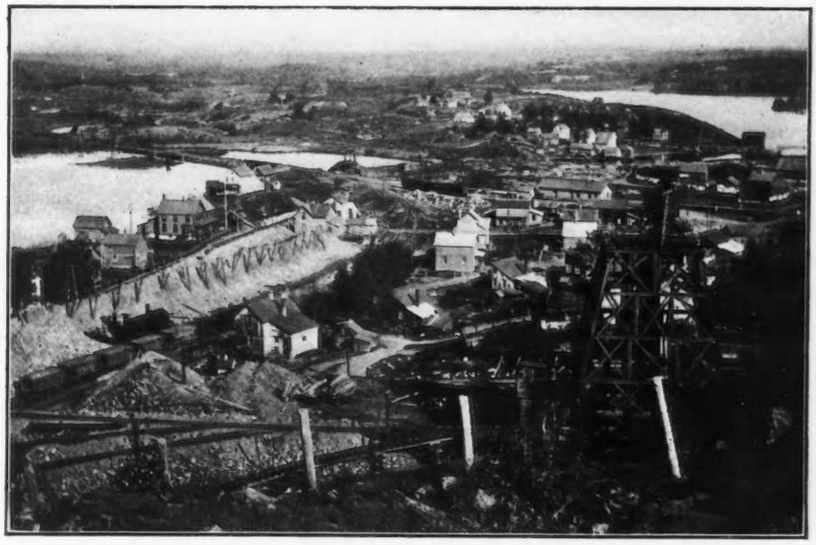


FIG. 8. VIEW AT REPUBLIC MINE, VULCAN, MICH., SHOWING OLD TIMBER HEADFRAME

This shaft had for 25 years been surmounted by a timber headframe having the form of a truncated pyramid 36 ft. square at the base, set upon a prismatic section; altogether about 60 ft. high. The long axis of the shaft has a general north-south direction. The headsheaves for the cage rope and skip rope lay in east-west vertical planes, the ropes leading from them down toward the east to an angle-sheave frame where the ropes were turned nearly at right angles, running thence in a southerly direction for about 1800 ft. to a second angle-sheave frame, from which they emerged in an easterly direction and entered the hoisting house.

This long and indirect route for the hoisting cables came about by reason of the use of the old No. 5 shaft hoisting drums for the then new No. 9 shaft. This solution of the problem of equipment for a new shaft is not unusual in the Lake Superior district. In addition to the two horizontal angles in the ropes, there were several slight vertical angles due to the profile of the ground over which the ropes ran. In the discussion preliminary to the design of a new headframe it was thought best to eliminate one of the two principal angle-sheave frames by letting the ropes run the 1800 ft. in a southerly direction directly from the headsheaves to the southernmost one of the two old frames. There were various other matters of rearrangement planned as an improvement over the original layout.

Regular Practice in Operation of Headgear

The common practice at the Vulcan and Republic mines is to dump the ore from the skip into a hopper or chute through which it slides by gravity into a transfer car operated by some form of rope haulage. This car carries

*Vulcan, Mich. Formerly structural engineer, Republic Iron Co.

the ore out to its destination, which may be either the stockpile or the shipping pocket where it is automatically dumped. The floor or platform upon which this car stands in the headframe is known as the landing floor. Where the neighboring ground surface is at about the same elevation as the shaft mouth, it is necessary in modern installations to have this landing floor about 40 ft. above the shaft collar in order to provide ample headroom for shipping pockets and stockpile trestles.

In the case of this shaft, a form of gravity haulage has been in use for some years. The tram tracks are placed on a strong down grade, varying from 2½ to 5%, leading out on the trestles to the stockpile dump, the wasterock dump, or the crushing plant dump, and the loaded transfer car is allowed to run out and be automatically emptied. On the way out, it is controlled by a rope attached to the car and to a drum at the heardframe, and the empty car is pulled back up the slope to the headframe by this drum, actuated by the skip hoist through the medium of a driver pulley keyed to the shaft of the headsheave and a rope drive delivering power to a follower pulley on the same shaft with the drum. This drum may be clutched to the shaft at pleasure. One man attends to the landing of the skip and operation of the machinery and car.

On account of the elevation of the shaft above the railroad tracks, a height, for the landing level, of about 12 ft. above the collar is sufficient to furnish the down grade referred to and still leave sufficient headroom for the various dumps.

Besides the cage and skip there was a skip counter-balance running in the shaft and requiring provision in the headframe.

In order to make certain references farther along intelligible, it will be necessary to give here a little explanation about the system of skip counterbalancing[1] in use at this shaft. By this system an auxiliary rope runs from the bottom of the hoisting drum to an auxiliary drum, called the balance drum (see Fig. 3). From the other end of this balance drum another rope runs to and over the headsheave and down into the shaft, where it is attached to the balance weight that travels up and down the shaft between ordinary guides. This balance drum is made with varying radii, thus giving a varying-moment arm for the pull of the ropes. These radii are proportioned so that the dead weight of the skip and that portion of its rope which hangs in the shaft is, at all points in its downward and upward travel, very closely in balance with the weight of the counterbalance and that portion of its rope which hangs in the shaft. The balance drum usually takes the general form of a double cone. In this case, however, the shaft end of the drum is a spool, upon which a flat rope runs to the headsheave and counter-weight. Of course the varying diameter of the coil as the rope winds on or off furnishes the varying moment arm needed for the system. The other, or hoist portion of the drum, is of the usual form with sloping face.

When the skip (Kimberly type) goes into the dump in the headframe, it of course exerts less pull on its rope or "loses weight" by reason of its resting partly on the dump members of the headframe. With the perfect counterbalancing just explained, this loss of weight is sufficient to prevent the emptied skip from moving out of the dump when it is started downward again into the shaft. It is therefore necessary to compensate for this loss of weight by taking on weight from another source—hence the "take-on balance."

This take-on balance is a weight of about 1500 lb. traveling in a balanceway built from the ground up into the headframe. It is attached to a rope, or a pair of ropes which are led over small headsheaves and around various deflecting sheaves and attached to a fixed support in such a way and at such an elevation as to lie horizontally across the center of the skipway ready to be engaged by wheels on the top of the skip frame just when the skip box begins to lose weight in entering the dump. It will be readily seen that by having the horizontal portion of these ropes of some length, the effect of the take-on

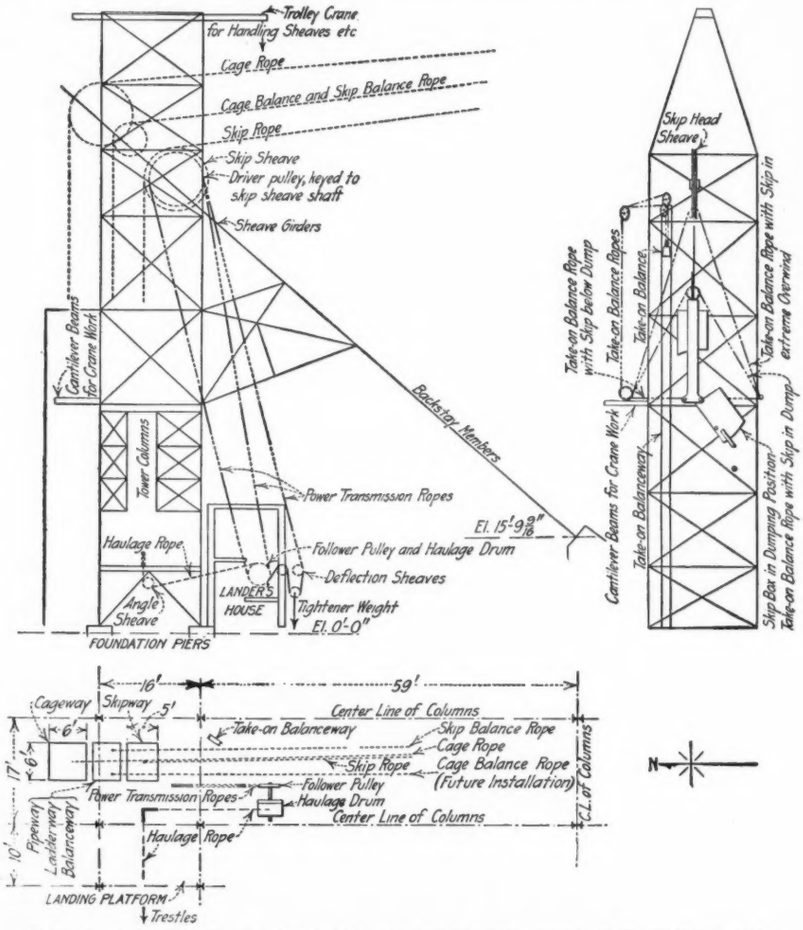


FIG. 2. GENERAL LAYOUT OF HEADFRAME, HOISTING ROPES AND BALANCING SYSTEM

[1]A complete description of this system may be found in the "Proceedings of the American Institute of Mining Engineers," meeting of February, 1914, as part of a paper entitled "Use of Electricity at the Penn and Republic Iron Mines, Michigan," by William Kelly and F. H. Armstrong.

balance is gradually increased to correspond approximately with the gradually decreasing weight of the skip.

General Design of the Headframe

A survey disclosed the fact that the long or north-south center line of the shaft lay at an angle of only 1¼° from a straight line joining the shaft with the distant angle-sheave frame mentioned. Therefore it was decided that the center line of the headframe should be aligned parallel with the shaft, thus avoiding a slight obliqueness in the alignment of support of guides, dump, etc. The center of the two principal compartments lying thus so nearly in a common line to the distant angle-sheave frame, the two main sheaves would be very nearly in the same vertical plane and of course would be in tandem (see Fig. 4), instead of parallel arrangement as they had been in the old headframe and as they are in the majority of headframes. This tandem arrangement generally introduces a good deal of complication to the design of a headframe, and this case was no exception to the rule.

The site of the shaft is at the foot of a steep rocky slope which forms the north end of the bold and extensive jasper outcrop, so prominent a part of the distinctive geology and the remarkable scenery at Republic. The hoisting ropes were to lead directly to the brow of the bluff and, with the height of headframe required, this topographical relation made the ropes actually slope upward in leading away from the headsheaves—an unusual condition. This of course made the resultant of the rope stresses lie very flat. A glance at the profile sketch (Fig. 3) will make these features clear.

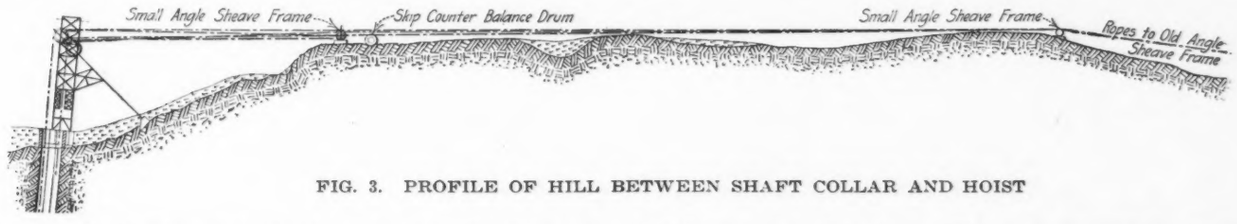


FIG. 3. PROFILE OF HILL BETWEEN SHAFT COLLAR AND HOIST

The shaft being a deep, important and permanent one, structural steel was chosen almost as a matter of course as the material for the headframe. In deciding upon the general form of the headframe and the location of its members, it was necessary to keep in mind the matters of support and clearance for four headsheaves with their hoisting cables; the take-on balanceway and its sheaves and ropes and fixed support for rope ends; the dump plates, hopper, platform, car, and track; the large rope drive, driver-pulley on the skip-sheave shaft and the rope-drive ropes; means for convenient handling of the headsheaves; suitable provision for handling miscellaneous loads on two sides of the headframe; and convenient floors, stairways, ladders and railings as means of reaching all vital parts.

In working out the design, it was considered desirable to have a structure wherein the principal stresses produced by the hoisting should be perfectly determinate and as far as practicable be confined to a few members through which they would be transmitted directly to the earth. These objects required the backstays to lie in the plane of the resultant for each and every rope, and called for the peculiar arrangement of sheaves whereby all four of them are located in the plane of backstays. Placing the backstays at such a flat slope forced their bases out a long distance from the shaft, making it necessary to adopt the six-post type of headframe in which there are four vertical columns in the immediate region of the shaft, forming by themselves a complete tower against which is leaned, so to speak, the backstay portion of the frame. The backstay portion is to a large extent independent, being braced to the tower only in the upper portion of its height.

As a matter of fact these objects have not been attained with absolute perfection, since the pillow blocks for the sheaves are placed on the top flange of the girder struts, thus putting the center of the sheave about a foot from the plane of the center lines of the backstays instead of exactly in that plane.

Also the resultants from the four hoisting ropes do not all fall exactly in the same plane, since it was not convenient so to arrange matters on the hill that all the ropes from headsheaves to hill should be exactly in parallel planes. As a result of this lack of perfection the vertical tower portion of the frame does carry a slight compressive stress from the hoisting.

Detail Description of Design

The details of the design are shown in Figs. 5 and 6. It was thought best to gain the advantage of short girts, beams and diagonals by making the headframe narrow and the tower portion short. This narrowness also allows teaming of supplies close to the east side of the shaft. To allow for plenty of clearance for the skip throughout its dumping operation and a possible overwind, and to provide clearance for the travel of the take-on ropes the west columns were placed 10 ft. from center line of shaft. This position was also found to furnish a good central support for the hopper, which is a heavy affair and subject to much stress by the impact due to the dumping of ore. The east columns were placed 7 ft. from the center line of the shaft to allow of suitable bearing for the column piers. This made a total width of 17 ft., which is little enough for the general stability of a structure of 100 ft. total height.

For a similar reason, the length of the tower portion was reduced to a minimum (16 ft.) that would still provide for stairways, landings and other minor but necessary features. To attain this object, the front of the tower was placed across the center compartment of the shaft, and the cageway was thus left outside the main structure. The near or south guide of the cageway was easily bracketed out from the north girts of the tower. The outer or north guide was not so readily supported since there must be clear space for the travel of the cage. Believing that about 50 ft. of clear cageway would be sufficient for safety, overwind possibilities and all traffic of handling long materials on or under the cage, its travel was stopped off at elevation 51 ft. by a triangular horizontal bracket reaching out to the north side of that compartment to furnish horizontal support for the

upper end of a vertical backing-beam to which the north guide is bolted. This beam was built up by riveting a 10-in. channel to one flange of a 10-in. I-beam.

The tower proper is surmounted by a trolley-beam crane from which all the sheaves can be readily handled. A trolley is provided and the web of the beam is also perforated at short intervals for the ready attachment of

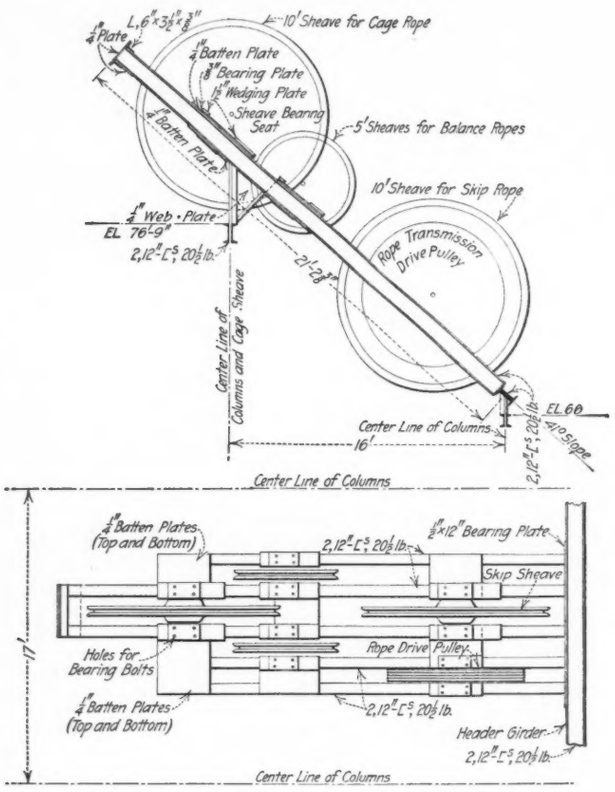


FIG. 4. DETAILS OF SHEAVE SUPPORTS

a clevis at any desired point along its length. This trolley-beam cantilevers out both to the north and to the south. The south end—extending over the backstays—is intended for a support for hoisting the sheaves from the ground. An open space is provided in the upper panel of the backstays through which the sheaves may pass while being hoisted. The north end, extending over the cageway, could with less facility be used in the same manner, but is intended only for general convenience in handling and temporarily storing sheaves or their bearings; thus one sheave could hang suspended from this north end while other sheaves are being handled on the main portion of the beam. The trolley beam is readily reached by means of two ladders, one on each side.

A comfortable stairway leads up from the ground to the top of the tower proper, the maximum slope of the stairs being about 50°. All floors or landings are of reinforced concrete built on "Multiplex Plates." All stairways and landings are well inclosed by riveted angle-steel railings. At several points these landings and stairways extend outside of the tower frame. Such an extension of the floor occurs at the base of each trolley ladder and provides a safe and convenient platform for entering or leaving the ladders.

No swinging jib crane is provided for general handling purposes. Instead there are at an elevation of 36 ft. 6 in. on the north and east sides of the structure, cantilevered beams provided with clevis holes from which tackle can be suspended to handle any material desired. One pair of these beams extends out from the skipway, while the others extend in front of the cageway on either side.

Provision is made for four headsheaves, but only three are installed—a 5-ft. sheave for the skip balance, a 10-ft. sheave for the cage, and a 10-ft. sheave for the skip. The fourth sheave will some time be put in to carry the cage-balance rope. Up to the present the cage has never been counterbalanced. The bearings of these sheaves all rest on a series of sheave girders set in the plane of the

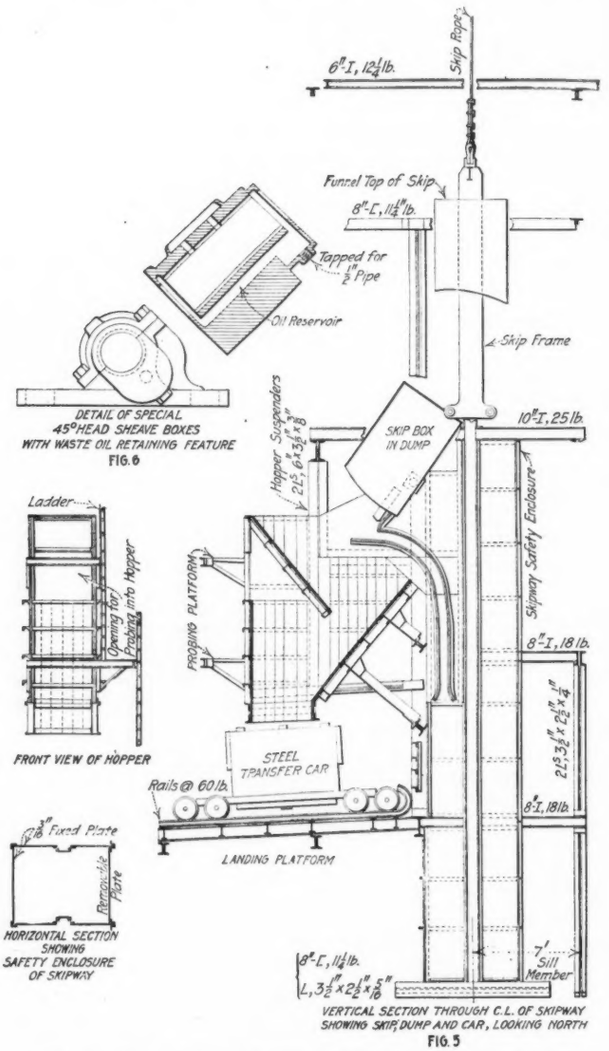


FIG. 5. SECTION THROUGH SKIPWAY AND DUMP
FIG. 6. DETAIL OF 45-DEG. HEAD-SHEAVE BOXES

backstays. These girders are of built-up eye-section, each being formed of two 12-in. 20½-lb. channels set ¼ in., back to back. The lower ends of these girders or girder-struts bear upon a cross girder of similar section which receives the hoisting stresses and through the medium of certain trusslike bracing delivers them to the backstay columns.

(To be concluded)

1914 Mineral Production of Western Australia

The mineral production of Western Australia in 1914 has been officially reported as follows, the items being given in long tons, except when otherwise stated, and in order of descending value: Gold, 1,232,977 oz.; coal, 319,210; lead ore, 3554; tin, ore and ingot, 363; copper ore, 3913; silver, 189,837 oz.; copper ingot, matte, etc., 183; pyritic ore, 9759; bismuth, 9; zinc, spelter, etc., 22; mica, 4. The total value of the mineral output for 1914 was £5,533,990, or $502,125 less than that of 1913.

Regulation of Oil and Gas Wells in California

By Lewis H. Eddy*

Protection of the natural resources of petroleum and gas in California against improper operation by producers is provided for in an act passed by the last Legislature and approved by the governor, known as Senate Bill No. 916, introduced by Senator Maddux. This act provides for state control under direction of the state mineralogist, creating a special branch of the State Mining Bureau known as the Department of Petroleum and Gas.

The work of the department will be performed by a state oil and gas supervisor appointed by the state mineralogist. The compensation of the state mineralogist for supervising the new department is $1400 per annum, in addition to his compensation of $3600 as state mineralogist. The compensation of the supervisor is $4500 per annum. The supervisor will appoint not more than four deputies, also clerical assistants, and he may employ an attorney. The deputy supervisors shall be competent engineers or geologists experienced in the development and production of petroleum. It shall be their duty to collect all necessary information regarding oil wells with a view of advising operators in the protection of wells from infiltration of water. Records and data shall be kept on file in the offices of the deputies and open to inspection of persons authorized by operators and the state officers and the board of arbitration. The records are not to be used as evidence except in such proceedings as are provided for.

The supervisor shall order such experimental or remedial work to protect wells as his judgment dictates. The well owner may within 10 days from service of the order file a statement and demand arbitration by a board of three members. Two members of the board shall be selected by owners of wells and they shall select the other member. They shall be paid for actual services at the rate of $10 for each day, not to exceed $30 each in the arbitration of any one case.

One-third of the owners or operators of wells within a radius of one mile may make written complaint, upon which the supervisor or deputy must make investigation of the well or wells complained of and order the work required to repair the damage. If the supervisor holds that such repair is not necessary, the complainants may demand arbitration.

In obedience to the order of the supervisor or the arbitration board, the owner of the well shall commence work in good faith within 30 days. If the work be not commenced within the time limit, the supervisor shall appoint agents to perform the work and the amount expended shall be a lien against the well or the land. The decision of the board of arbitration or supervisor may be reviewed by the Superior Court within 30 days.

It should be the duty of the owners of wells now drilled or that may be drilled to case such wells properly with metal casings, and to use every effort for protection in accordance with the most approved methods.

Before abandoning a petroleum or gas well the owner shall give written notice to the deputy supervisor of intention to abandon, 15 days before such proposed abandonment and shall furnish information of the condition of the well and proposed method of abandonment. The supervisor or deputy shall either approve or order such work as may be necessary before approval.

The owner of any well before commencing the work of drilling shall file with the supervisor or deputy written notice of intention, stating location, elevation and designation of the well, and estimates of depth at which oil or gas sands of formation should be encountered, and the point where water should be shut off. The owner shall keep a careful and accurate log of drilling, to be subject to inspection of the supervisor and his deputies, and the copy filed with the deputy, including additional work. Five days in advance of a test to shut off water in a well, a deputy supervisor shall be notified and be present at such test and record the result. If any test should be unsatisfactory, he shall so notify the owner. Producers of oil shall file with the supervisor once a month a sworn statement of the amount and gravity of the oil produced, and the number of wells being drilled, the number producing, idle or abandoned. Refusing to permit inspection or hindrance of such inspection will be deemed a misdemeanor. Operators of petroleum and gas wells shall pay annually to the state treasurer a charge at uniform rate per barrel of oil produced and amount of gas sold in the preceding calendar year. Owners of oil lands shall pay to the state treasurer an annual charge at a uniform rate per acre.

Estimates of amounts necessary to be assessed and collected from the owners of wells and land, for the maintenance of the department, shall be determined by the state mineralogist in conjunction with the state board of control. Notice of such assessment shall be published annually in newspapers in Fresno, Kern, Los Angeles, Orange, Ventura and Santa Barbara Counties. Assessments and charges constitute a lien upon all property of owners of wells or lands so assessed or charged. Action against the state treasurer may be brought by persons so assessed upon claims that the assessment is void. Collection of delinquent assessments will be prosecuted by the attorney-general.

The firt assessments under this law shall be levied on the first Monday in March of 1916 and based on the production of 1915, and are due and payable upon the first Monday in July following, and delinquent in six weeks thereafter. Action for delinquency shall be brought in the following May. The moneys will be expended under direction of the state mineralogist; $45,000 annually to be allowed for maintenance of the department; and all moneys in excess of this amount shall be available for repairs of wells made by the supervisor upon failure of the owner, and for costs of publication and in defense

*Associate editor, "Engineering and Mining Journal," San Francisco, Calif.

of actions in court. Appropriation of $20,000 from the general fund of the state is made available for the immediate use of the department, to be returned to the general fund when collections equal $30,000. The act of Mar. 20, 1909, which had become practically obsolete, is repealed.

Iron and Steel Production of Canada in 1914

The iron and steel production of Canada in 1914, as collected and reported by the statistical bureau of the American Iron and Steel Association is given in Bulletin No. 5 of the association. The production of pig iron shows a heavy decrease, 30.5%, as compared with 1913, and is the smallest reported since 1909. The make for three years has been as follows:

	1912		1913		1914	
	Tons	%	Tons	%	Tons	%
Basic	489,799	53.6	558,524	55.0	331,456	46.9
Bessemer	228,742	25.2	227,662	22.4	184,053	26.1
Foundry	194,208	21.2	225,231	22.2	174,546	24.7
Other	129	...	3,701	0.4	16,117	2.3
Totals	912,878	100.0	1,015,118	100.0	705,972	100.0

The total production in 1914 included 690,880 tons made with coke as fuel and 15,092 tons with charcoal. Ontario furnished 503,214 and Nova Scotia 202,758 tons. Of the total for the year 515,527 tons were used by the makers for conversion into steel, and 190,445 tons were merchant iron, for sale. Deliveries from furnace were: Molten, 449,713; sand-cast pigs, 188,135; machine-cast, 68,106; direct castings, 18 tons.

The raw material used in 1914 was 1,358,184 tons of iron ore, cinder, etc.; 419,864 tons limestone; 910,887 tons coke; 883,625 bu. charcoal. The average consumption per long ton of iron made was 4309.4 lb. ore and 1332.2 lb. limestone. The coke furnaces consumed 2,611.4 lb. coke per ton of iron; the charcoal furnaces 105.5 bu. charcoal.

There are 22 blast furnaces in the Dominion, 11 being in Ontario, 8 in Nova Scotia and 3 in Quebec. Their total estimated capacity is 1,564,800 tons yearly. Five furnaces use charcoal as fuel, their average yearly capacity being 14,560 tons; 17 use coke, having a yearly capacity of 87,750 tons each.

Steel Production

The steel production of Canada for 15 years past has been as follows, in long tons:

1900	23,577	1905	403,449	1910	741,924
1901	26,084	1906	570,889	1911	790,871
1902	182,037	1907	646,754	1912	853,031
1903	181,514	1908	509,957	1913	1,042,503
1904	148,784	1909	678,751	1914	694,447

The sudden increases in 1902 and 1905 were due to the completion of new works. The make in 1914 was less than that of 1913 by 348,056 tons, or 33.4%; and was the smallest reported since 1909, five years previously.

Magnesite Discovered in British Columbia

Magnesite has been found in large quantities along the shore of Lake Atlin, in the northwestern part of British Columbia. Seven claims have been located by Vancouver parties, and plans are being made for working the deposits. This ore is shown by analysis to run as high as 98% in magnesium carbonate. The world's supply has so far come from California, Greece and Austria. On account of the war the latter source is cut off, and since this was the most important there is an extraordinary demand for the mineral which British Columbia will soon be in a position to supply. Magnesium salts are used in the arts, in medicines and in connection with the pulp industry of this province. This new discovery may prove to be of special importance, since the chief value of the spruce forests in British Columbia is in their paper-making possibilities, and the fact that magnesia necessary to the manufacture of a finished product is right at hand may result in greatly increasing the importance of the two industries.

Interstate-Callahan Zinc Makes Record Profits

Special Correspondence

Cœur d'Alene mine-earning records have been eclipsed by the Interstate-Callahan company, which owns and operates the Consolidated Interstate-Callahan mines, in the Nine Mile district. The net profit for the quarter ended June 30, 1915, was $1,126,114, according to the report of John A. Percival, secretary-treasurer.

The total ore extracted was 30,595 tons and the concentrates and shipping ore produced was 14,872 tons. Of the crude-ore shipments there were 68 tons averaging 21.05 oz. in silver and 44.60% lead, and 2834 tons averaging 49.74% zinc. The milling ore treated amounted to 27,235 tons, averaging 27.8% zinc, and the concentrates produced were 851 tons averaging 26.72 oz. in silver and 59.49% lead and 11,399 tons averaging 48.24% zinc.

The recovery of zinc values by sorting and milling was 78.28%, and the ratio of milling ore to total concentrates was 2.2:1. The mining costs were $3.07 per ton; milling costs were 67.2c.; and loading and shipping costs were $1.267, making the total cost of the ore mined $4.285 per ton.

The Interstate-Callahan company, of which John H. Robbers, Spokane, is president and general manager, inaugurated dividend payments last April, and $1,610,000 have since been disbursed to stockholders.

Gems and Precious Stones in the United States in 1914

The total value of the output of precious and semi-precious stones in the United States in 1914 is reported by the Geological Survey at $124,651. The demand for gems at the Panama-Pacific Exposition resulted in an increased production of turquoise and turquoise matrix, the production in 1914 being $13,370, as compared with $8075 in 1913. These gems have long been popular with the tourist trade in the West.

No discoveries of unusually fine deposits of gem minerals were made in 1914, but a few prospects for the less valuable gems were found. Among these were pink beryl in the quarry of the Maine Feldspar Co., on Mount Apatite, near Auburn, Me.; amazon stone, a variety of feldspar, near Lone Pine, Calif., White Plains, N. Y., and on the coast of Maine; sunstone in the Apache Indian Reservation of Arizona; and turquoise deposits in Lander and Eureka Counties, Nevada.

The Wisconsin Zinc District--III

By H. C. George*

SYNOPSIS—Milling practice of the Wisconsin zinc district is much like that of Joplin, Mo. The difference is in detail; but the Wisconsin mines do not concentrate on tables following the jigs. Jigs are usually of the Cooley type. Roasting and magnetic separation are practiced. Descriptions of all processes are given.

The milling practice of the Wisconsin zinc district is in a general way similar to that of the Joplin, Mo., lead and zinc district; that is, the ore is crushed and jigged. In details, however, the process is different. None of the average Wisconsin mines supplements jigging with the concentration of sands on tables. The usual mill consists of crusher, rolls, one or two jigs and the necessary trommels and elevators. Figs. 29 and 29A show a plan and flow sheet, and Fig. 30 an elevation of a typical Wisconsin zinc mill with steam power-plant, except for the use of a Wilfley table for sands.

The mills of the district are housed in frame buildings on concrete foundations. The cost of a mill with all machinery varies from $10,000 to $30,000, depending on its capacity and equipment. The usual practice of the district is to build the concentrating plant or mill adjoining the hoisting derrick and hopper, but frequently the ore is conveyed on the surface as much as half a mile from the shaft to the mill. In this case the hopper at the shaft feeds onto a belt conveyor, or into surface tram cars or aërial tram buckets or cars, which deliver the ore at the mill hopper.

After the ore is hoisted, it is delivered onto a grizzly above the hopper. The grizzly has the bars spaced from 4 to 6 in. apart. The oversize is either sorted by hand (the pieces containing ore being broken by sledge hammers to pass through the grizzly bars, and the waste rock loaded into cars and dumped on the surface outside the hopper) or it is all fed to a large crusher, which breaks all of the large pieces of rock and ore and discharges them into the hopper with the undersize. From the hopper, which usually has a capacity of 100 to 200 tons, the ore is fed directly into a 14-, 18- or 24-in. crusher of the Blake type, or onto a shaking screen. In the latter case the fine material passes through the shaking screen and goes direct to the dirt elevator, and the coarse material or oversize is fed to the crusher.

Material from the crusher runs down an inclined trough to the first roll crusher, which is usually a 24-, 30-, 36- or 48-in. machine of the Cornish type. The crushed material from these rolls is carried in an inclined trough to the dirt elevator. The first elevator feeds into a trommel with ⅜-, ¼- or ⅝-in. perforations. The oversize from the trommel is fed to the second rolls, usually 24 or 30 in., of the Cornish type, and from these rolls it is returned to the dirt elevator and thence again to the crushers.

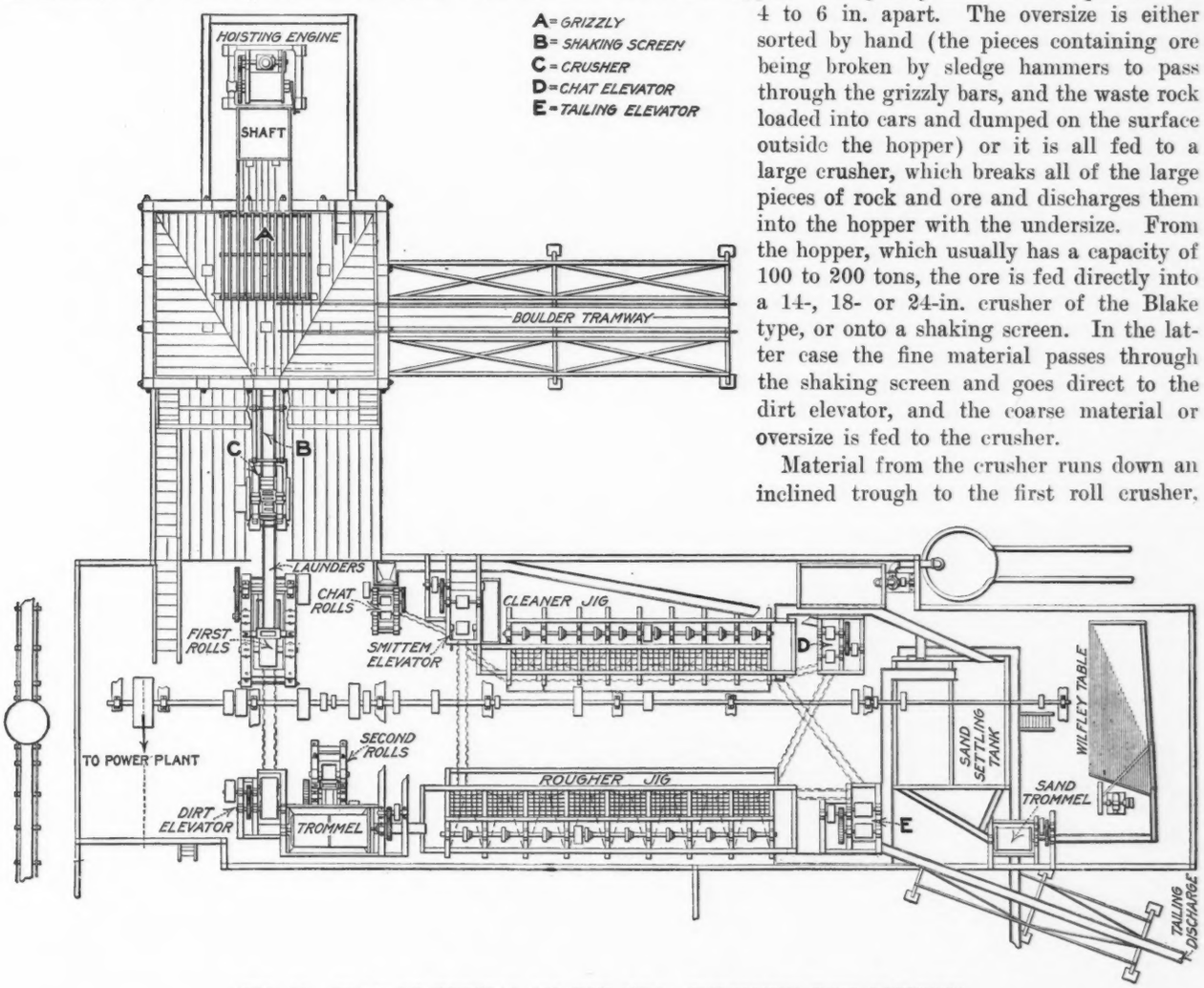


FIG. 29. PLAN OF TYPICAL 150-TON MILL, WISCONSIN ZINC DISTRICT

*Chief engineer, Wisconsin Zinc Co., Platteville, Wis.

The undersize product from the trommel is fed onto the rougher jig in a two-jig mill or onto the combined rougher and cleaner jig in a one-jig mill. Up to this point the process is the same in the one- and two-jig mills, but from this point the processes are different and will be treated separately.

One-Jig Mills

The jig, usually of the Cooley type, consists of 7, 8 or 9 cells, each cell generally having a 30x36-in. jigging surface. A common pitch from cell to cell in a jig having

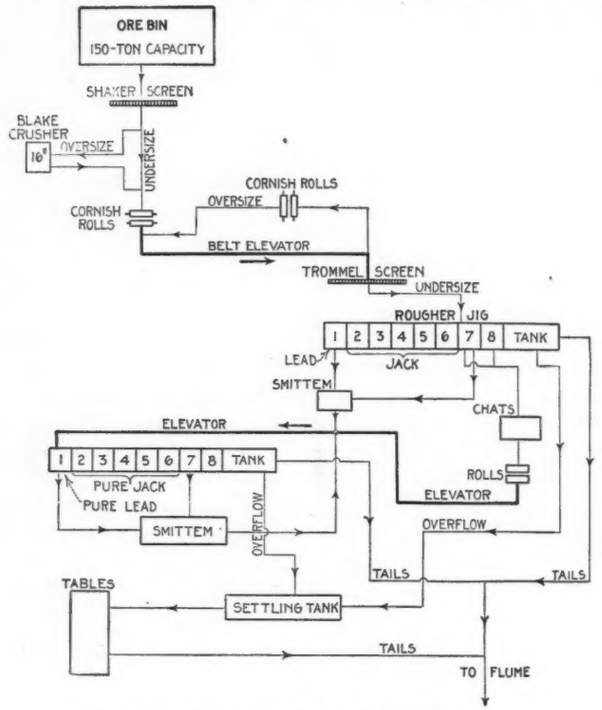


FIG. 29A. FLOW SHEET OF 150-TON MILL

30x36-in. cells is 1¾ in. per cell. The amount of water used in milling varies from 800 to 1200 gal. per min. The first cell is used for cleaning lead, and cells 3, 4 and 5 are used for cleaning zinc in the 7-cell jig, and cells 3, 4, 5, 6 and 7 are used for cleaning zinc in the 9-cell jig.

Mixed lead and zinc product from the second cell is either returned to the dirt elevator or the chat elevator. The product from the eighth and ninth cells in a 9-cell jig and from the sixth and seventh cells in a 7-cell jig is sent to the chat elevator. From the chat elevator the material is sent to the chat rolls, usually of the 24-in. Cornish type. The crushed material from the chat rolls is returned to the dirt elevator. In some one-jig mills there are no chat rolls, and in this case the chat material is fed to the second rolls with the oversize from the trommel.

Recrushing is necessary for this material in order to free the zinc and iron sulphides from the lead sulphides and from limestone. The material that passes over the lower end of the jig to the dewaterer carries from 4% to 6% metallic iron as iron sulphide and from 1% to 2% metallic zinc as zinc sulphide. This material is carried from the dewaterer at the end of the jig to the tailings elevator, from which it is discharged through a trough to the ground at some point near the mill. A common size for the sieves or grates on the first, second and third cells is usually a ¼-in. perforation; on the fourth and fifth cells, ¼-in. perforation, and on the sixth, seventh, eighth and ninth cells, $\frac{3}{16}$-in. perforation. Fig. 29 shows the plan of a rougher and cleaner jig in a mill and Fig. 31 shows a vertical cross-section of a jig cell. In Fig. 31 *K* shows the sieve or grates, *L* is the hutch or part of the cell below the sieve; *M*, the spigot for drawing from the hutch; *N*, the spigot for drawing from the bed or the part above the sieve, and *P*, the jig-plunger compartment. In the one-jig mill, concentrates are drawn from the spigots *M* and *N* in the cells used for cleaning ore.

Two-Jig Mills

The two-jig mill process is practically the same as the one-jig mill process up to the point of the delivery of the undersize product to the jig. The two-jig mill has a rougher jig, with from 5 to 9 cells, usually with a 30x36-in. jigging surface on each cell, and the cleaner has from 5 to 7 cells of the same size. For convenience of description I will take the case where the rougher and the cleaner each has 7 cells. A common construction in the jigs of a two-jig mill of this type is for the sieves or grates in the first 5 cells of the rougher to have ⅛-in. perforations and the sixth and seventh cells to have $\frac{1}{12}$-in. perforations, and the first three cells of the cleaner have $\frac{1}{16}$-in. perforations, and the last 4 cells $\frac{1}{12}$-in. perforations.

In the two-jig mill process, this product is fed to the rougher, which has from 5 to 9 cells, usually with a 30x36-in. jigging surface. The oversize or sieve product on the middle cells of the rougher is cleaned and drawn

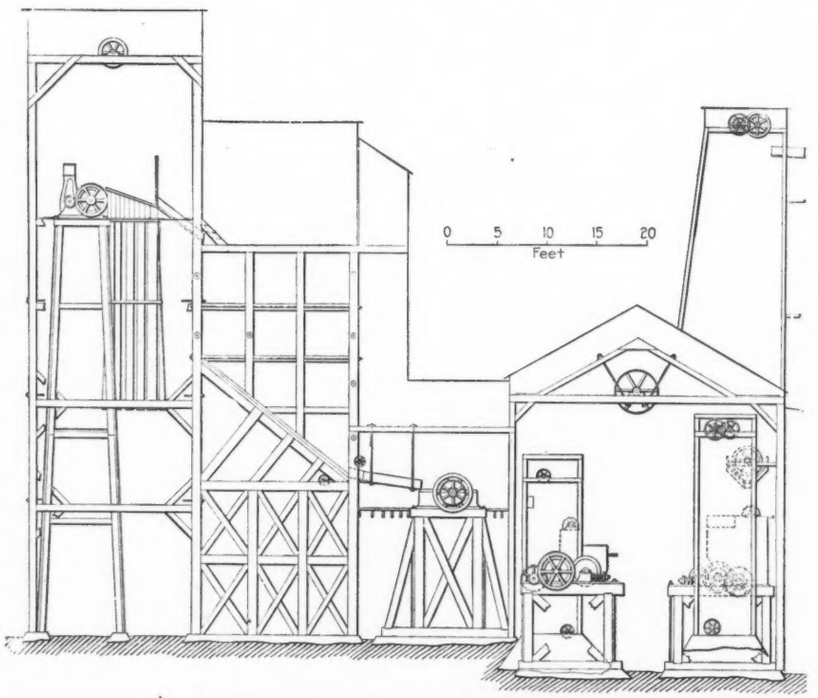


FIG. 30. END ELEVATION OF ZINC MILL

from the spigot *N* when the product is not chatty. When the ore is chatty it is drawn and taken to the chat elevator, and from there to the chat rolls, whence it is returned to the dirt elevator. Fig. 32 shows a flow sheet of a typical two-jig mill. In case the sands are not treated this product is run into the tailings elevator instead of to the sands elevator, as shown in Fig. 32.

The hutch product from the rougher, the "smittem," is carried to the "smittem" elevator and from there to the cleaner jig, where it is cleaned. The finished lead concentrate is drawn from the hutch of the first cell of the cleaner. The hutch or middling product from the hutch of the second cell is returned to the "smittem" elevator. The hutch product from the third, fourth, fifth and sixth cells is finished zinc concentrates. The hutch product from the seventh cell when not chatty is returned to the smittem elevator, but when chatty it is returned to the chats elevator. The material passing over the tailboard of the cleaner jig is sent to the tailings elevator, unless the sands are to be treated on a sands jig, and in that case it is taken to the same elevator, as shown in Fig. 32, or when the cleaner tailings contain much zinc they are returned to the dirt elevator or to the chats elevator. Jigging is done on three materials in the district—perforated sheet steel, jig grates and woven-wire screen cloth. The first of these is most commonly used, it being claimed that it has the advantage over grates in that no "dead beds" exist, because of the greater perforation area, which produces better and more uniform pulsations on the beds. This enables the ore to be cleaned better, and is especially advantageous in keeping down the lime and lead content of the zinc concentrates. It is also claimed that perforated metal (sheet steel) adapts itself better to a variable feed to the jig. Grates have the advantage over perforated sheet steel and woven-wire screens because the bed does not have to be cleaned so often with the grates.

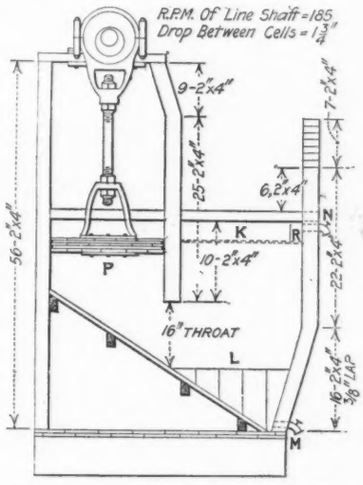


FIG. 31. CROSS-SECTION OF JIG

Concentrating Tables

Concentrating tables have been very little used in the Wisconsin zinc district. The Vinegar Hill Zinc Co. uses two Overstrom tables and one Ford table at the Wilkinson mine for concentrating marcasite sands. The Wilfley table has been successfully used at the Wallace mine at Highland, the Board of Trade mine at Cuba City, and the Avenue Top mine at Dubuque, Iowa. All of these mines have produced zinc concentrates from the jigs assaying better than 50% Zn.

The Wilfley table has been tried at a number of mines where the zinc concentrates from the jigs assayed from 30 to 45%; but because of the greater sliming of the marcasite much lower-grade zinc concentrates have been produced, and they have been difficult to market. On account of their fineness and the resulting dust losses they are not suitable to roast in the local calcining plants.

The classification of sands and the handling of the different products over different tables have been difficult on account of the small amount of ore handled daily in a Wisconsin mill, but this difficulty may be overcome with the larger mills being built in the district at the present time and the greater attention being given to the question of mill recovery.

Roasting or Calcining

A feature of the district is the roasting or calcining and magnetic separation of low-grade zinc ores. The Mineral Point Zinc Co. at Mineral Point, Wis., has a plant with five roasting kilns of the Mathey type. This plant uses Wetherill magnetic separators and has a capacity of about 300 tons of green or unroasted ore per week. The Wisconsin Zinc Co. has a plant with two roasting kilns of the Mathey type located at Platteville, Wis. This plant is equipped with Dings magnetic separators and has a capacity of about 250 tons of green ore per week.

The National Separating Co. has a plant with two roasting kilns of the Mathey type at Cuba City, Wis. This plant is equipped with Dings magnetic separators and has a capacity of about 300 tons of green ore per week. The

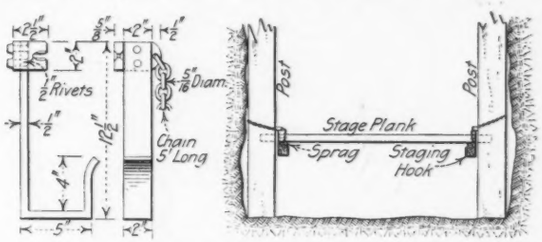


FIG. 32. FLOW SHEET OF ZINC TREATMENT

Campbell Magnetic Separating Co. has a plant with four roasting kilns of the Campbell type at Cuba City, Wis. This plant is equipped with Campbell separators and has a capacity of about 300 tons of green ore per week. During the past year this plant was leased by the Wisconsin Zinc Co. The Linden Zinc Co. has a plant with two roasting kilns of the Campbell type at Linden, Wis. This plant is equipped with Campbell magnetic separators and has a capacity of 150 tons of green ore per week. There are also several roasting plants of the Mathey type at different mines in the district and one custom roasting plant of this type near Galena, Ill., not operating.

The roasting or calcining process consists of heating the ore in the kiln by coal or oil fuel in an adjoining fire box. Coal is used in the Mathey roaster and oil is used in the Campbell roaster. The sulphur in the ore aids in the combustion. Only the outer crust of the fragments or particles of marcasite or pyrite are changed by the heat to a magnetic sulphide, which, after the ore is discharged from the kiln, cooled and fed to the magnetic-separating machines, is picked out of the feed of mixed zinc and iron sulphides by the magnets of the separating machines and discharged as a tailing product.

The feed to the roasting kiln usually assays from 20% to 40% metallic zinc. The finished ore from the magnetic separators assays from 58% to 61% metallic zinc. The tailings from the magnetic separators assay from 3% to 8% metallic zinc.

All of the companies named in the preceding page as operators of magnetic-separating plants buy ore running from 20% to 40% metallic zinc for their roasting plants, besides treating that from their own mines. In addition to these companies, a number of the zinc-smelting companies have buyers in the district. These buyers purchase high-grade ores from the mines and the roasted ore product from the separating plants.

The smelting companies that have ore buyers in the district are the Mineral Point Zinc Co., with a smeltery at DePue, Ill.; the Grasselli Chemical Co. with smelteries at Clarksburg, W. Va., and Meadow Brook, W. Va.; the Matthiessen & Hegeler Zinc Co., with a smeltery at La Salle, Ill.; the Illinois Zinc Co., with a smeltery at Peru, Ill.; the American Zinc & Chemical Co., with a smeltery at Langeloth, Penn., and the American Zinc Co. of Illinois, with a smeltery at Hillsboro, Ill. The Illinois Zinc Co. and Matthiessen & Hegeler Zinc Co. buy zinc concentrates low in lead, because much of their spelter product is rolled into sheet zinc. The Grasselli Chemical Co. buys zinc concentrates low in lead because it makes a high-grade spelter for the brass and bronze trade. The other smelting companies are not so particular about the lead content of the zinc concentrates because they make prime Western spelter for galvanizing purposes.

The buyers for the smelting companies purchase on a base of 60% metallic zinc contents in the zinc concentrates. They penalize $1 per unit of zinc below 60% and pay a premium of $1 per unit above 60%. Iron is penalized at the rate of $1 per unit over 1%; lime at 50c. per unit over 2%; and lead at $1 per unit over 1%. This scale of penalties and premiums usually applies to concentrates containing from 50% to 63% metallic zinc. For ores of a lower grade a different scale is used. Some ores are purchased on contract, based on the spelter market, a fixed or given smelting charge, and the metallic zinc content of the concentrates.

Three-fourths of the production of the district is made by five companies. The following list gives the principal operating mines of the district, their location and the name of the operating company:

The foregoing list contains only about half of the properties that have produced ore during the past year, and does not contain the names of any properties not equipped with a milling plant, but it does include the names of all of the big producers of the present time in the zinc district.

The mines of the district are widely scattered, few of them being nearer than a mile to any other mine. Prospecting is being carried on largely by the big companies, with good results. The production of the district grew from 19,000 tons of concentrates in 1904 to 130,000 tons in 1914. Taking into consideration the scattered nature of the ore deposits, the size of the district and the number of mines that have been found with a small amount of prospecting, it is safe to predict a steady growth, a long life, and a bright future for the Wisconsin zinc district.

FIG. 33. THE KENNEDY MINE, HAZEL GREEN, WIS.

PRINCIPAL OPERATING MINES

Mine	Location	Company
Coker	Livingston, Wis.	Mineral Point Zinc Co.
Highland	Highland, Wis.	Mineral Point Zinc Co.
New Coker	Livingston, Wis.	Mineral Point Zinc Co.
Penna Benton	New Diggings, Wis.	Mineral Point Zinc Co.
Fox	Hazel Green, Wis.	Mineral Point Zinc Co.
Kennedy	Hazel Green, Wis.	Mineral Point Zinc Co.
Black Jack	Galena, Ill.	Mineral Point Zinc Co.
Rundell & Ellsworth	Livingston, Wis.	Vinegar Hill Zinc Co.
Martin	Benton, Wis.	Vinegar Hill Zinc Co.
Wilkinson	Benton, Wis.	Vinegar Hill Zinc Co.
New Unity	Day's Siding, Ill.	Vinegar Hill Zinc Co.
Winskell	New Diggings, Wis.	Wisconsin Zinc Co.
Champion	New Diggings, Wis.	Wisconsin Zinc Co.
Federal	Hazel Green, Wis.	Wisconsin Zinc Co.
East End	Platteville, Wis.	Wisconsin Zinc Co.
Frontier-Calvert	Benton, Wis.	Frontier Mining Co.
Bull Moose	Benton, Wis.	Frontier Mining Co.
Cleveland	Hazel Green, Wis.	Cleveland Mining Co.
Lawrence	Hazel Green, Wis.	Cleveland Mining Co.
Lucky Twelve	New Diggings, Wis.	Indian Mound Min. Co.
Crawhall	New Diggings, Wis.	Fields Mining Co.
Pittsburg	Galena, Ill.	Great Western Min. Co.
West Hill	Platteville, Wis.	West Hill Mining Co.
Kistler	Platteville, Wis.	Kistler Mining Co.
Optimo	Linden, Wis.	Optimo Mining Co.
Lucky Six	Mifflin, Wis.	Lucky Six Mining Co.
Squirrel	Mifflin, Wis.	B. M. & B. Mining Co
Peacock	Mifflin, Wis.	Peacock Mining Co.
Northwestern	Day's Siding, Ill.	Northwest'n L. & Z. Co

United States Graphite Output

According to the Geological Survey, the production of natural graphite in 1914 in the United States amounted to 4336 short tons, valued at $324,118. Of this quantity, 1725 tons were amorphous, valued at $38,750, and 2611 tons were crystalline, valued at $285,368. The greatest part of the crystalline graphite—all the "flake" variety—was produced in New York, Pennsylvania and Alabama. A small quantity of crystalline graphite was produced in Montana. The entire output of natural graphite in 1914 showed an increase in value as compared with that of 1913, but a slight decrease in quantity.

Early History of Braden Mines*

SYNOPSIS—Traditions surrounding the Braden copper mines and the early Chilean operations are recounted by William Braden, who also tells of the modern exploitation, the difficulties of construction in a new country and how these difficulties were overcome.

The traditions of the Braden Copper Co.'s mines date from the 18th century, when a Spanish lieutenant (*teniente*) who was a fugitive from justice escaped to the snow-crowned Andes between Chile and the Argentine, where he camped at what afterwards became known as the Mineral Teniente. This man is said to have discovered there a vein of high-grade ore, and out of the proceeds of shipments of it, to have paid to the authorities a fine which freed him from further difficulties with the colonial government. Be this as it may, the first official records date from 1819, when the working of the mine was undertaken by Don Juan de Dios Correa, *conde de la Conquista,* and owner of the immense hacienda stretching from the coast range of the Chilean Andes to the Argentine boundary, within the limits of which the mines are situated. Don Juan de Dios exploited the mine until the '70s of the last century, transporting the ore on muleback to the coast for exportation.

The First Smelting Plant

Partners were taken into the enterprise about that time, and one of them, Don Federico Gana, a graduate of Freiberg, took charge. He drove what is now known as Teniente No. 1 adit, to tap the orebody which until then had been attacked only by irregular inclined workings from the surface. A shaft was sunk from this adit to a depth of over 100 m., and an underground *malacate* was installed. An inclined wooden chute carried the ore down the mountain to a sorting floor near the *lagunas* or small lakes at the foot of the hills; and a smelting plant was installed at Perales, about 15 miles distant, near the junction of the Coya and Cachapoal Rivers. In short, what was considered an uptodate and progressive exploitation was undertaken.

On account of the heavy snowfall at the mines, no work was done during the winter months beyond keeping the shaft dewatered and preparing the mine for the extraction of high-grade ore during the ensuing working season.

According to one version of the accounts referring to operations at this time the mine boss and miners, during one of the winters, stole about all of the tools and equipment that could be carried off; and the following spring the owners found the shaft full of water. Another version is to the effect that water was suddenly encountered and that miners in the lower workings had barely time to escape, so rapidly did the water rise. At all events money was then required to get the mine into a state of production. The money not being forthcoming, the mine was abandoned and the taxes left unpaid.

About 1897, Don Enrique Concha y Toro, an enterprising mine capitalist, sent a prospector to the district; and after taking up claims to cover some of the most promising croppings including the old Teniente mine, he proceeded to sort high-grade ore from the old stopes of the latter, and sell it.

Correa Heirs Bring Suit

Don Carlos Irarrázaval, who was married to Doña Nicolasa Correa, the heiress of Don Juan de Dios Correa, then brought suit in the interest of the Correa estate, to enjoin Don Enrique Concha y Toro. The difficulties between the parties were adjusted after some legal warfare, by an arrangement giving Don Enrique a third interest in the Teniente mine, and the sole proprietorship of all the other mining claims which he had taken up in the neighborhood.

The Correa heirs would invest no capital in the business; and Señor Concha y Toro, not caring to work for the benefit of others in the Teniente, in which his partners owned a two-thirds share, limited his operations to looking for ore in that part of the property of which he was sole owner. He thus explored the Capitana and Subteniente, but principally the Fortuna mines, where he executed underground workings covering an area of about 100x150 ft. and reaching a depth of 150 ft., always on the lookout for shipping ore. This he did not find, as all the copper was in fractures of, or disseminated through, diorite country which made up a 4% Cu ore, requiring concentration on a more or less important scale to be profitable.

Effort to Interest European Capital

An Italian mining engineer, Don Marco Chiapponi, was consulted under these circumstances, as to what could be done with the property, and he recommended the construction of a concentrating plant. As such an installation, with the necessary wagon road, power plant and other equipment, involved more capital than Señor Concha y Toro cared to invest in what was considered a low-grade mine, Chiapponi was entrusted with the sale of the property.

Signor Chiapponi sent about 25 tons of the ore to Europe for concentrating tests; and as these proved successful, the business was submitted to mining capitalists in France and England. Engineers were sent to examine the property; but they were apparently unable to grasp the magnitude of the proposition, which, moreover, was at that time a new one in its way; and they reported adversely on it.

Mr. Braden Inspects and Invests

About two years later, Signor Chiapponi proposed the business to William Braden, who after careful inspections, formed a favorable opinion of it, and interested his friend E. W. Nash—since deceased, then president of the American Smelting & Refining Co., and one of the most enterprising of mining and smelting men in the United States—in the organization of the Braden Copper Co. for the exploitation of the property with a cash capital of $625,000.

With this money it was proposed to open up and equip the mines; build a wagon road about 35 mi. long to connect them with Graneros, a station on the Chilean state railroad 1600 ft. above the level of the sea, or about 6000 ft. lower than the mines; erect a 250-ton concentrating

*Excerpts from an article by William Braden in "Teniente Topics," June, 1915.

mill; construct three aërial trams; install a hydro-electric plant of approximately 1000 hp.; and provide living quarters at the mine and mill camps.

Equipment Completed as Scheduled

In view of this undertaking being the first of its kind in the Chilean Andes, and of its being realized under many little-known conditions it was with satisfaction that the plant was completed, and concentration started in the month of June, 1906, within the time set for beginning exploitation.

The usual route for reaching the mines had formerly been by trail from Rancagua through the village of Machalí, about 45 mi. distant, passing through the Isla ranch along the south bank of the Coya River. There were no houses at the property other than a couple of "rucas"—small low huts, with walls of loose rock and roofs of loose sheets of corrugated iron held in place by the weight of judiciously-strewn boulders. . . . The wagon road from Graneros was concluded in 1905. During the winter months of that year—June, July and August—about 4000 tons of machinery and construction material had been accumulated at the freighting station, La Compañia, near Graneros, for transportation to the mine; and it certainly looked like a big task.

Several Chilean gentlemen hazarded the opinion that it would take three or four years to haul this material to the Cordillera; and when it was explained that the company proposed not only to haul the material, but finish the plant and start running it the following June, their expressions of incredulity verged on the borders of derision. By hustling, the company's expectations were, however, fulfilled. There were as many as 250 ox-carts at work at one time—which meant the employment of over 2000 animals. These carts were at work on the farms in the neighboring country; and it was possible to induce the cartmen to leave their congenial surroundings in the wheat fields and orchards of the low-lying plains, for the work of hauling heavy loads to the Cordillera, only by paying them what was considered a very high rate of freight—25 pesos, Chilean paper currency, equal at that time to about $7.50 per ton. As a matter of fact, they responded to the call promptly.

Securing Labor in a New Country

Advertisements were inserted in the newspapers, and placards posted throughout the agricultural districts inviting them to "Come one, come all!"

About 1000 Chilean laborers were employed in the construction work at the camp during the summer season of 1905-6, that is from September to May inclusive. During the first months there were no houses for them. When a group of laborers presented themselves for work they were given a few sheets of corrugated iron, and they promptly built themselves a *ruca*. Some groups of workmen cooked their own meals; but the company maintained kitchens in tents where most of the men took their meals.

The work was accomplished, and in fact was only possible, by a defiance of the customs of the country. These, including immoderate consumption of liquor and the observation of numerous feast days, besides Sundays, throughout the year, were supposed to constitute a necessary evil with which it would be impossible to cope. Nevertheless, the introduction of liquor into the camp was prohibited, and gradually it was practically suppressed. The men learned to work instead of "laying off" on all the feast days.

Labor Efficient Under Proper Handling

Labor, man for man, was cheaper than in the United States; and under efficient direction, the company got as much out of Chilean labor, dollar for dollar, as could be gotten from labor in North America. Throughout the construction period, work went on smoothly. The men were well handled by their chiefs, who were always "on the job" and who gave an example to the peons—of which the latter showed their appreciation—in punctuality, steadiness and perseverance.

The construction of the mill was intrusted to W. E. Bradley; the power plant was in the hands of C. E. Doolittle; the aërial trams were built by Thomas Graham; and the opening up of the mine was undertaken by Thomas M. Hamilton. The work in the mine was different from anything the men had ever seen before, and at first was undoubtedly hard on the miners; but Mr. Hamilton's example of tireless energy and his genial character alike appealed to the men, who recognized in him a leader and a friend. While exacting strict compliance with duty, he always lent an attentive ear to suggestions, complaints or other representations of the men; he redressed every just grievance to which his attention was called, and patiently gave them object lessons in the proper handling of tools and employment of explosives—through which they worked out their contracts to better advantage, and contentedly reaped a good pecuniary harvest.

No Fatal Accident During Construction

Although there was a certain amount of danger connected with the work, much of which was done on the steep slopes of high rugged mountains where pieces of heavy timber were handled for the tram towers and other work, in places where many people would think there was no foothold for a single man, there were no accidents attended with loss of life during the construction period.

The first death by accident in the camp took place shortly after construction was finished and concentration had begun. It happened in the portal of the old Teniente mine where a miner, despite the company's regulations and in a manner approved among natives pretty much all over the Andes, tried to thaw out 46 sticks of dynamite in a shovel nicely balanced over the flames of a bright fire in a brazier 2 ft. in diameter. Somehow or other miners there will do this sort of thing with impunity over and over again until they think it is the proper way to go about the business. On this occasion it was not done with impunity. Fortunately there was no one present except the miner who stood on one side of the shovel, and his assistant who stood on the other; and strange to say, although both were the same distance from the explosive only the assistant was killed, the other escaping unhurt, suffering merely from slight deafness for a few days.

Rivalry in Construction Operations

At the time the fever of construction activity was at its height, there was considerable rivalry among the chiefs, each one of whom vied with the others in strenuous effort to get his part of the work completed first. Incidentally amusing and sometimes also annoying accidents took place. One day, while a bench for the Teniente power flume was being blasted out of the solid rock on the hillside just above the proposed course for the aërial tram, the

flying rock completely wrecked three tram towers; and the disgusted tram-construction superintendent, who had been congratulating himself on the rapid progress he had been making, could not be convinced that the shot had not been fired especially to knock down the towers and retard his work.

It was with difficulty that about 50 men were induced to "invernar" or pass the winter of 1905 in the mountains. The thing was accomplished, however; and before the following winter set in there were bunkhouses and living quarters for several hundred men. As an incentive to the laborers to stick to their work steadily, every man who worked from May to September was presented gratis with a number in a lottery, which was started in the camp, with prizes from 100 to 500 pesos, besides a few "consolation" prizes. This system was successfully used for several years to insure a full complement of workmen.

While the construction work was going ahead, at the camp and for some time after, the railroad to connect the mines with the state railroad at Rancagua was being surveyed, and the grade built almost as fast as it was surveyed. The work was at first under the direction of W. Titus, but was afterward taken over by George E. Montandon, who, in the rocky regions of the Cordillera, had to overcome many difficulties. The road rose from 480 m. above the sea at Rancagua, to its first proposed terminal station at the camp, 2016 m., with maximum grades of 4.5%, and curvatures rendered necessary by the topography of the country, which made the road 70 km. long, although the distance in a straight line between terminals was only 34 km.

Elk City and Dixie Mining Districts, Idaho

EDITORIAL CORRESPONDENCE

The Black Pine Mining Co. has completed its small mill for treating the ores from its property. At present the mill is not in operation, all efforts being centered upon advancing the tunnel which is to cut the oreshoot, rich on the surface, at a depth of about 275 ft. The mill has five stamps, with mortar block and timbering completed for an additional five. Plates and concentrators are provided, and the output will consist of bullion and concentrates. Power is supplied by a 120-hp. water turbine, supplied by a flume carrying water from the American River.

The Buster mine, near Elk City, is still shut down. The condition of the vein at 400-ft. depth is not considered satisfactory, and the principal owners, Bradley and MacKenzie, have decided not to carry out further explorations. Conditions are not good in the district and not much work is being done.

The Elk City Dredging Co. has been reorganized and operations are being continued on what is considered a satisfactory basis. The dredge has been rebuilt, the ladder having been lengthened so as to enable it to reach bedrock. The gravel is said to contain about 50c. per cu.yd. At the Col. Sellers mine, L. Basketh is operating in a small way, extracting high-grade ore from stringers. This ore is being roasted without crushing, which results in a mixed product, the largest pieces of which are about 1 in. in diameter. The material is cyanided, in this condition, by leaching. A 10-stamp mill is being built to handle the lower-grade ore. Amalgamation and cyanidation will be the process.

In the adjoining Dixie district there are no notable developments. No continuous operations are being carried on, although some ore is being milled at intervals and there is some development in progress.

Willow Creek and Broad Pass, Alaska

SPECIAL CORRESPONDENCE

The Willow Creek region, already known as one of the most prominent free-gold mining districts of Alaska, bids fair to become of even greater importance this year than heretofore owing to the recent discovery of several additional bodies of high-grade ore. A cleanup made early in July by the Gold Bullion Co. resulted in the shipment of over $16,000 in bullion said to run over $19 per ounce. The Alaska Free Gold Milling Co., which operates in the same district, expects to clean up $250,000 before cold weather terminates milling operations for the season. A portion of this amount, however, will be obtained by cyaniding the tailings. The Independence Mining Co., which at present operates but a small mill, has recently uncovered some excellent ore and will probably increase the capacity of its plant. An encouraging discovery made upon the Mabel group of claims has revealed the presence of richer ore than had hitherto been found upon this property. From a discovery prospect in the same district a couple of men working by crude methods on a small scale have been taking out $30 per day.

The Broad Pass region, owing to the lack of transportation and the fact that it is not a placer- but a quartz-mining country, has not hitherto been exploited to the extent that its merits warrant. The new railroad will pass directly through the heart of the district, which in addition to gold-bearing ore has deposits of excellent coal. Transportation being assured, it is believed that the coming year will witness a thorough prospecting of the entire region.

Du Pont Co. Doubles Capital

A plan for the sale of the E. I. du Pont de Nemours Powder Co. to a new company, to be known as E. I. du Pont de Nemours & Co., has been arranged by the directors and will be put in effect when approved by two-thirds of the stockholders. The purchase price is to be $120,000,000, of which $1,484,100 will be in cash, $59,661,700 in debenture stock and $58,854,200 in common stock.

The authorized capitalization of the old company was $60,000,000, of which $16,113,807 in preferred stock and $29,428,708 in common stock was outstanding, a total of $45,542,515. Besides this there were bond obligations amounting to $16,922,000.

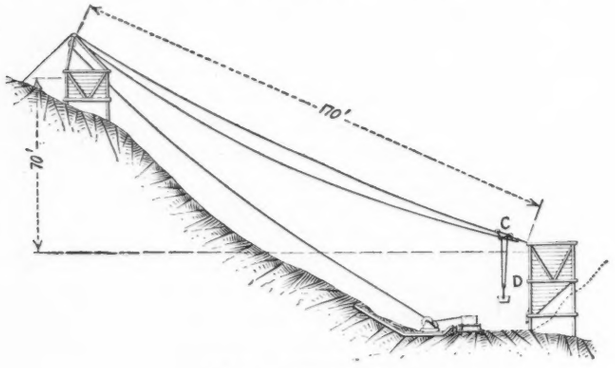
Potash Supply may come from the Philippines, according to a letter published in the "Daily Commerce Reports" of the Department of Commerce. It has been found that the ash of the seaweed collected on the shore of Manila Bay in Tondo yields 15% of potash. This discovery has aroused considerable interest, owing to the war-time scarcity of potash. No data are available to show just the amount of seaweed available, but it is known in a general way that it is abundant. Explorations and further experimentation will be conducted by the Government.

Details of Practical Mining

Alaskan Ore-Hoisting Rig

By Walter Swaren*

An interesting arrangement for reducing the attendance in conjunction with hoisting equipment at an Alaskan gravel mine is shown by the accompanying sketch. The particular work to be done by this installation was transmitting gravel from an ore bin—to which it was trammed from an open cut—to a breaker 70 ft. higher than the ore bin and on the opposite side of the cañon from the open cut. Several similar rigs have been put in operation for hoisting from a shallow shaft, a tripod being erected over the mouth of the shaft to take the strain of the cable of both hoisting and conveying. The installation here shown is designed to carry a load of 1500 lb. at a maximum speed of 400 ft. per min., although its normal speed is usually 200 ft. per min. The track cable is 7/8 in. and the



ORE-HOISTING RIG

hoisting rope 3/8 in. diameter. Two buckets are provided; while one is being loaded at the ore bin, the second is being hoisted.

The operation is as follows: The bucket *D* being loaded, the hoist hook is fastened in place. The traveler *C*, by a special locking arrangement, is held in position at the lower end of the track rope until the block carrying the bucket *D* has been hoisted vertically to the carrier. When the bucket is pulled to the carrier it is automatically caught by means of a trigger arrangement which releases the catch holding the traveler *C* at the lower end of the rope; the hoist continuing to run, draws the carrier *C* carrying the bucket up the track rope. A long loop of chain is attached to the uphill side. When the bucket has reached the upper ore bin this chain catches on a post or projecting beam and automatically dumps the bucket.

After dumping, by slacking off on the winch at the foot of the hill, the empty bucket drops to the lower end of the cable where the carrier engages the catch, and the bucket is released and dropped vertically into the ore bin or the mouth of the shaft, as the case may be. The first bucket, being released from the hook, the second bucket is attached, and the cycle of operation is repeated.

*R. R. No. 2, Box R, Hayward, Calif.

Turbines vs. Engines in Units of Small Capacities*

The term "units of small capacity" is here intended to include turbines and engines of less than 500-hp. capacity, including auxiliary units in large plants or central stations.

There are certain definite fields where the small turbine is of conceded superiority, and other fields wherein the engine must hold sway. The desirability of the one as compared with the other is largely determined by the following factors, which govern the adaptability, cost and economy of the equipment to be installed:

1. Speed conditions and limitations, involving consideration of maximum or minimum permissible speed, and whether the driven apparatus is of the constant- or variable-speed class, or such as requires uniform angular velocity in rotation.

2. Steam pressure and temperature conditions, involving consideration of initial and final pressures and superheat.

3. Power capacity of apparatus.

4. Relative space requirements of turbine and engine units, involving consideration of available room, character of power-house construction and cost of foundation or other supporting structure.

5. Use of application, if any, of the exhaust steam for feed-water heating, steam heating or industrial purposes.

6. Available cooling-water supply, if the turbine or engine is to run condensing, involving also consideration of the temperature of the water and whether it must be artificially cooled and recirculated.

7. Operating conditions, including consideration of attendance, oiling, starting and stopping, vibration, noise, etc.

8. Relative cost of complete installations, including the necessary foundations, piping and condenser equipment, if any.

Summarizing, the fields of usefulness of the turbine and engine may be briefly stated to be as follows:

For condensing service, turbines are best adapted to: Direct-connected 60-cycle generators in all sizes, 25-cycle generators above 1000-kw. capacity; direct-current generators in sizes up to 1000-kw. capacity, including exciter units of all sizes; centrifugal pumping machinery operating under substantially constant head and quantity conditions, and at moderately high head, say from 100 ft. up, depending upon the size of the unit; fans and blowers for delivering air at pressures from 1½-in. water column to 30 lb. per sq.in.

For noncondensing service turbines are applicable for all the above purposes, in those cases wherein steam economy is not the prime factor or where the exhaust steam can be completely utilized, and particularly where oil-free exhaust steam is desirable or essential.

*From a paper read by J. S. Barstow before a joint meeting of the A. S. M. E. and A. I. E. E. at the Engineers' Club, Philadelphia.

Still another field for the turbine is in geared units operating either condensing or noncondensing for all the aforementioned applications, and in addition, many others which would otherwise fall in the category of the steam engine, on account of the relatively slow speed of the apparatus to be driven.

For noncondensing service, engines are applicable for: Electric-generators of all classes excepting exciter sets of small capacity, unless belted from the main engine; centrifugal pumping machinery, operating under variable head and quantity conditions and at relatively low heads, say up to 100 ft., depending on the capacity of the unit; pumps and compressors for delivering water or gases in relatively small quantities and at relatively high pressures—in the case of pumps at pressures above 100 lb. per sq.in. and in the case of compressors at pressures from 1 lb. per sq.in. and above; fans and blowers (including induced-draft fans) for handling air in variable quantities and at relatively low pressures, say not over 5-in. water column; lineshafts of mills where the driven apparatus is closely grouped; and all apparatus requiring reversal in direction of rotation, as in hoisting engines and engines for traction purposes.

For condensing service the engine is adapted to the purposes cited, particularly where the condensing-water supply is limited, and must be recooled and recirculated.

Power for Driving an Aerial Rope Tramway*

When an aërial tramway has to be driven by power, the amount necessary is obtained from the following formula, the result being in foot-pounds per minute:

$$Power = [(W_1 + W_2 \times \mu_1 \times \frac{N}{2} \times V) + (w \times 2L \times \mu_2 \times V) \times (2R \times V) + F] + or - theoretical\ power$$

Where

W_1 = Weight of full carrier;
W_2 = Weight of empty carrier;
μ_1 = Coefficient of friction for cars;
N = Total number of cars on line;
V = Velocity in ft. per min. of cars;
w = Weight per ft. of traction rope;
L = Length of line in feet;
μ_2 = Coefficient of friction for traction rope;
R = Number of supporting pulleys;
F = Power required for station friction.

The first four factors give the power necessary to overcome friction, and the theoretical power required or developed depends upon whether the loads are ascending or descending. The factor for station friction varies greatly for different lines and is solely a matter of experience, although 0.02 of the total weight of the moving parts in the station, multiplied by the speed, may be taken as a good mean.

When the line is of considerable length and consists of several sections, it often happens that one section is developing power while another needs power; in which case the latter may derive from the former the whole or part of the power it requires. Should an excess of power be developed over the whole line, it may be utilized in various ways, such as driving dynamos, pumping, etc.

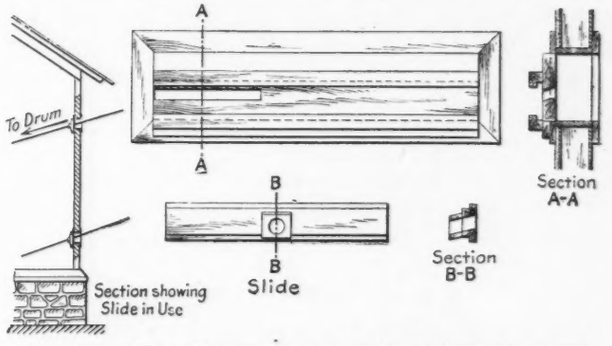
*Abstract from article in the "Engineer," London, July 23, 1915.

Sliding Board for Hoisting Ropes

By D. E. Charlton*

The slide board shown in the accompanying illustrations possesses two advantages over the usual method used on hoisting ropes at the point where the rope passes out of the engine house and onto the idlers before reaching the head sheave. Regular practice is to have a rectangular opening in the engine house at this point, through which the rope passes. This opening varies in length and width, but in nearly all cases is of sufficient size to admit considerable air. This in the summer months may be a desirable feature, but is not so in the winter. There is also a tendency on the part of the rope to have a certain amount of play, particularly in a vertical direction, and the use of such a device does not permit this at this point. The device may be placed on the original opening, as shown in the illustration, or may be built to suit any particular opening.

It consists of a 1¾-in. pine board, cut to fit the opening and toenailed into it, and slotted as shown—either on one side or the other, depending on whether it is for the lower or the upper rope. Below this a 1-in. strip of the same length is fastened to the frame of the opening,



DETAILS OF SLIDING-BOARD FOR HOISTING ROPE

so that along with the board already mentioned it forms a base to which the guides for the slide are fastened. These are of oak.

The slide, as shown in the lower elevation, is also of oak and made so that it moves along the guides with perfect freedom. The projecting piece is fastened to the main part of the slide. The inclined hole should be of sufficient size to permit of but slight play in the rope. The slide may be made entire or of two parts.

Packs, Sand Filling and Solid Pillars†

The substitution of packs and sand filling for isolated small solid pillars is gradually becoming general in the mines of the Rand. In describing the big subsidence at the Village Main Reef, attention was drawn to the fact that it was the solid ground which was affected by the rock movement. The only explanation seemed to be that the hanging-wall had slowly subsided onto the packed sand until no further movement was possible. As that subsidence must have also included the area held up by the

*Mining engineer, Virginia, Minn.

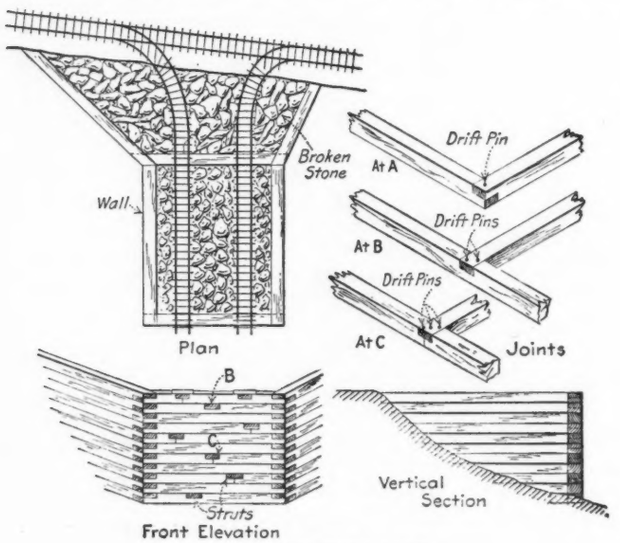
†Abstract from the "South African Mining Journal," July 10, 1915.

solid-rock pillar, it was clear that the latter had reached a state of acute compression and was disturbed by general movement of the underlying strata. This was sufficient to burst away the sides of the pillar, filling the drifts with débris and damaging the shaft timbers. The interesting feature of that occurrence was the fact that the area which could reasonably have been regarded as the safest and strongest became under the circumstances the weakest and most dangerous. An inspection of the immediate neighborhood of the shaft immediately after the occurrence revealed the fact that the workings and drifts in the sand-filled area were quite unaffected, no disturbance of the filling being detected. The result of that unusual accident was to detract considerably from the value of solid pillars unless they cover an excessive superficial area. Sand filling appears to be more effective, as it presents a slightly elastic resistance, allowing the strata to subside gradually without hurting the continuity of the hanging walls. The contrast to this is the solid pillar with its puncturing effect.

A Log Retaining-Wall

By Frederick W. Foote*

At a property with which I was recently connected, a railroad grade on the side of a steep mountain connected with an incline down the mountain. To allow room for



LOG RETAINING-WALL

the turning of the cars at right angles to the direction of the track by means of a short radius curve, it was necessary to build out the ground. This was done by constructing a timber retaining-wall which was filled with broken rock removed from the grade.

The logs for this wall were hewn by contract requiring two sides to be flat and the faces to be at least 2 ft. wide. The contractor received 25c. a running foot for his labor. After the logs were cut and measured, the lumbermen were hired by day labor to "snake" them into piles by use of a portable boiler and hoist situated upon the railroad grade. A mast and boom were then rigged in the center of the proposed wall. The trenches were laid out and dug to bedrock (4 to 5 ft.) in benches not over 3 ft. high. Where bedrock was over 6 ft. below the surface, the trench was only dug 6 ft. deep and broken stone used as a filling. The logs were then tarred on their flat sides and put in position by means of the mast and boom. Guide ropes on the ends of the log assisted in this operation. Holes were drilled along the top of the log every 5 ft. with an air-auger and home-made drift pins of ⅞-in. round iron were used to fasten each log to the next one below it. Logs were placed at right angles to the walls in toward the ground about every other tier, and were securely fastened to the main structure with drift pins. They were usually placed horizontally and served as binders when they were later covered with loose rock. They were placed in the wing walls as well as the front wall.

In this manner the wall was raised some 30 ft. A slight batter was given the walls which required about 6000 running feet of timber. The walls *A* were built similarly, as foundations for the ore bins. The incline cars ran under this ore bin.

*University, Va.

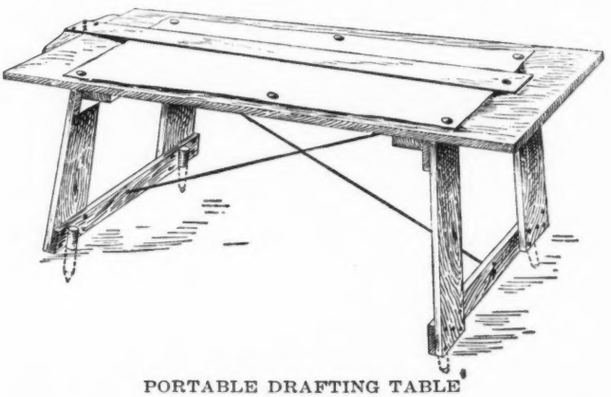
Drafting Table for Fieldwork

By Clinton P. Bernard*

A solid, steady drafting table, for use in fieldwork, that will take but little room in the wagon when moving camp and that may be set up on any kind of ground in two or three minutes, is a very desirable addition to an engineer's camping outfit.

The table described here I first saw used on a railroad outfit in the Southwest, and it was so satisfactory that I have used it several times since.

Two cleats 2 in. thick are screwed to the bottom of the



PORTABLE DRAFTING TABLE

drafting board or table, a suitable distance apart. The supports are made of 1x4-in. or 1x6-in. lumber as desired. Strong wires are fastened both at the top and at the bottom of one support and are passed through holes in the bottom and the top of the opposite support.

When setting up the table, stakes are driven in the ground 18 to 24 in. farther apart than the cleats on the board, so as to give a decided slant to the supports. The table is placed upon the supports, the wires stretched tight and held by winding around a nail, and the table is ready.

If the wires be stretched tight the table will be steady and firm and stand better than one supported by horses. The use of stakes may be avoided by using two spreaders of proper length between the bottoms of the supports.

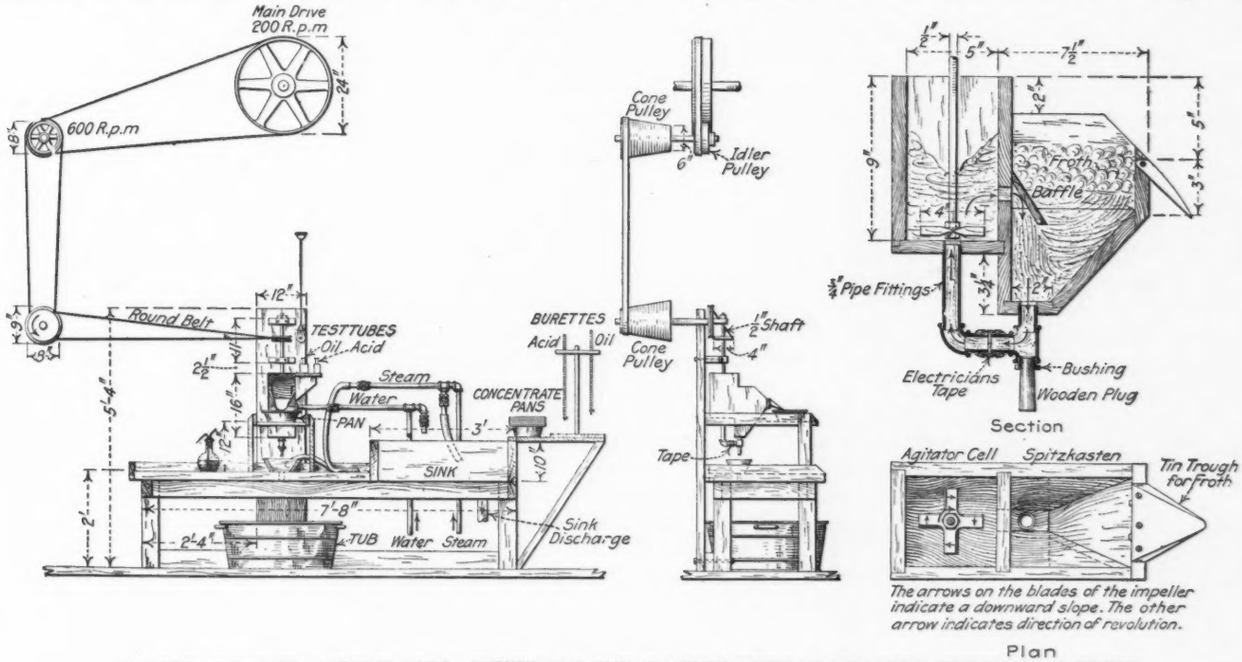
*34 Herriman Ave., Jamaica, N. Y.

Details of Milling and Smelting

Flotation Testing Machine

By Ralph W. Smith*

In designing a testing machine, it is well first to consider the character of work required of it, in order to arrange for flexibility in the desired directions. In flotation testing, there are so many influencing factors and their combinations, that must be varied in the testing work, that it is best to state these factors so that their relation to one another can be better appreciated. The variable factors are as follows: (1) Kind of oil; (2) amount of oil; (3) whether or not acid is to be used; (4) amount of acid (if used); (5) temperature of pulp; (6) length of time of agitation of pulp; (7) peripheral speed of impeller; (8) consistency of pulp; (9) effect of adding oil or acid first to the original pulp; (10) effect of retreatment of froth.



CLOSED-CIRCUIT, SINGLE-CELL, MINERALS-SEPARATION-TYPE FLOTATION TESTING MACHINE

Not only must all of these factors be varied, but their combinations must also be varied and this must be done systematically. The testing machine described in this article was designed to afford ample opportunity to vary any or all of the essential factors, and furthermore to allow the operator to make the necessary changes with the minimum trouble and loss of time. There are many other advantages in using a testing machine of this design, but attention is drawn to these as they are outlined. The design and reason for certain arrangements are as follows:

This machine comprises a single closed-circuit cell, which exactly reproduces the proportions of a single cell of a large commercial multi-cell machine. This design has two advantages: By reproducing these proportions, the same physical conditions are imposed on the pulp as would be imposed on it in the commercial machine; the froth concentrates can be removed continuously from this cell, conditions in a commercial machine being thus exactly reproduced.

To be able to duplicate commercial conditions means much in testing. To explain this, consider the work done by a large machine. It usually comprises from 8 to 11 cells (of which this testing-machine cell is an exact duplicate in regard to proportions). These cells are connected in series, so that the pulp passes from one cell to the next and so on until it has passed through all of the cells and is discharged as tailings. This number of cells is used so as to gain the desired length of time of agitation, since a single particle of ore can be considered subjected to treatment so long as it remains in the machine. Thus, the number of cells is one factor in determining the time period of the passage of a single particle of pulp through the machine.

Each cell can be considered a separate unit and each cell usually does its own particular kind of work. In most flotation practice, the first cell not only floats the greatest tonnage but also the highest grade of concentrates. It is nearly always found that the tonnage and assay per cell decrease as the pulp advances through the machine. The last one or two cells usually make a small tonnage of dirty concentrates. From this it can be seen that there is a practical limit to the time of agitation beyond which it is useless to go. When the final set of commercial operating conditions to be used has been determined upon from the testing work, there will be included among these conditions the speed and length of

*1845 Grant Ave., Denver, Colo.

time of agitation. Therefore it is imperative that the testing operator be able to determine these factors.

The second advantage of this design of testing machine—duplicating commercial operating conditions—depends on the fact that exact and reliable data can be obtained concerning the kind of work each cell would do in a commercial machine. This is because of the arrangement for continuous froth removal. With the closed-circuit cell as shown in the sketch the sulphide particles theoretically will become oiled in the agitator cell and ultimately be drawn over into the relatively quiescent spitzkasten. Here, the flotation phenomenon will manifest itself and the oiled mineral will rise to the surface. Not all of the sulphide minerals will rise instantly. Some particles may make the circuit from the agitator to the spitzkasten many times before they become incorporated in the froth. The most easily oiled mineral will float first, and the effect of the different gradations of this ease of being oiled is to form the froth slowly and continuously for some time. The froth that forms first is usually the heaviest and thickest. The eye can easily tell when the practical end point has been reached, since at that point, the froth appears thin and lean.

In testing machines of other design, there is no quiet pool in which to allow the froth to rise, but the froth forms directly over the swiftly swirling pulp in the agitator cell. In order to separate the concentrates from the tailings the impeller is stopped and a thin partition is inserted between the froth and the pulp. Thus, the froth is formed under unfavorable conditions and removed in an unscientific manner. There are several ways in which results can easily be "salted," high or low, in this type of machine. Furthermore, it does not duplicate commercial conditions.

The testing machine with the arrangement for continuous froth removal will furnish data relative to the kind of work that each cell of a commercial machine would do under the same conditions, as follows:

Assume the total length of time of agitation, or, total length of time during which froth is removed, to be 5 min. Then, the total froth formed and removed during the first, second, third, fourth and fifth minutes respectively, should be gathered in separate pans, weighed and assayed separately. The information contained in this data will indicate exactly the relative quantity and quality of concentrates which would be formed in the respective cells of a commercial machine, under the same conditions.

This constitutes the most important single advantage of this design. Ease of operation and handiness should be added to this, but these last two can be better appreciated after one has run some tests in the machine. Now as to the design in particular. In order to be able to determine the best speed of agitation, it is necessary that we have several speeds readily available when the testing work is being done.

In the sketches, it will be noticed that the method of drive is by cone pulleys and belts. A much neater and equally satisfactory drive is a small vertically mounted, electric motor, connected with a rheostat in order to obtain various speeds. But in many cases, the absence of available current for such a connection, makes this installation undesirable or even impossible. Since testing work of this character is often carried on in an operating mill, the most convenient method of drive depends upon the kind of power in the mill. If electric power be available or be used in the mill, the motor drive should be used. The machine under discussion was designed to be used in a mill where steam power is used, and other conditions did not seem to advise the motor drive.

The sketch explains itself. The weight of the shaft, impeller and pulley is supported by the set collar, shown on the upper end of the vertical shaft. One set collar only is used, so that the shaft can be lifted and changes or adjustments made in the impeller. The impeller shown on the end of the vertical shaft may be cut from a piece of $\frac{1}{16}$-in. sheet iron. The arms are bent in a direction similar to the blades on an electric fan. However, further attention should be given the bending of these arms. The direction of revolution of the vertical shaft should be traced out from the pulleys and belts, and the arms on the impeller should be twisted so that the revolving impeller will pull the pulp through the feed pipe directly underneath it. It is this lifting action which causes the efficient circulation of the pulp, which must be in the direction of the arrows in the cell sketch. The impeller can be fastened to the end of the vertical shaft by threading the end and using a nut above and below the impeller. The threaded portion of the shaft which might stick out of the impeller should be sawed off flush with the nut. This is done so that the impeller may be brought as close to the bottom of the agitator cell as desired. When in place the impeller should clear the floor of the agitator by $\frac{1}{4}$ in.

A convenient and satisfactory method of connecting the pipe fittings under the cell is by means of electrician's tape. An ordinary pipe union should not be used because there is a shoulder on it which necessitates the spreading of the parts shown, when the connection is made. The tape will not leak. When a test is being made, the tee at the base of the flotation cell is closed with a bushing into which has been driven a wooden plug. This arrangement has the advantage of leaving no chamber above it in which the pulp can settle. If a valve be used, it can at best only be connected by a close nipple, and this will leave a small chamber above the valve gate, into which some of the pulp will settle during the test, and receive no treatment. Results will therefore be inaccurate.

The water should be connected close to the bottom of the agitator cell, so as to wash the agitator out after each test and supply water conveniently for further tests. The steam should not be piped to the machine, since the steam will create a great disturbance if introduced into the cold pulp, if the pulp is relatively quiet. A much more satisfactory way is to connect it to a short length of hose as shown. When the pulp is to be heated the impeller should be running and the end of the hose should be pushed under the surface of the pulp in the agitator cell. If the steam is turned on under these conditions, the rapidly swirling pulp will cause the steam to enter silently, and the rise in temperature can be well observed in the front or spitzkasten. The particular charges of oil and acid, which are to be used in a test, should be placed at some convenient place as shown.

The cross-section of the cell shows its proportions, how it is constructed and the flow of the pulp. There are usually enough pulleys, shafting, lumber and belting around a mill, so that it is not necessary to order anything for this machine except the cone pulleys. An ordinary millwright or carpenter can construct the whole. If results are systematically sought and the machine properly attended, accurate and valuable results can be obtained from a machine of this design.

Lead and Zinc Movement

There have been such remarkable changes in the movement of lead and zinc during the past year that it is of special interest just now to give the figures of the Department of Commerce for the fiscal year ended June 30, which covers approximately a year of war conditions.

Imports and Exports of Lead

The imports and exports of lead for June and the fiscal year are reported as follows in short tons:

	June		Fiscal Year	
Imports:	1914	1915	1913–1914	1914–1915
Lead, metallic	1	2	118	405
Lead, ore and base bullion	2,521	2,537	30,093	41,230
Total imports	2,522	2,539	30,211	41,635
Exports:				
Domestic lead, exports	.....	5,401	.....	86,512
Foreign lead, re-exports	976	1,912	23,768	29,929
Total exports	976	7,313	23,768	116,441

The imports of lead in ore and base bullion in 1914-15 included 38,080 tons from Mexico and 1672 tons from Chile. The imports from Mexico were almost double those of the preceding year.

Imports and Exports of Zinc

Imports and exports of zinc in metallic form for June and the fiscal year ended June 30 are reported as follows, in short tons:

	June		Fiscal Year	
Imports:	1914	1915	1913–1914	1914–1915
Blocks, pigs, etc	35	163	1,073	862
Exports:				
Domestic	269	9,470	1,998	128,345
Foreign (re-exports)	.....	1,286	140	11,116
Total	269	10,756	2,138	139,561

The comparison here is between a normal year and a year of war conditions, the effect of which is shown by the extraordinary increase of exports.

The imports and exports of secondary zinc products are given as follows, in short tons:

	June		Fiscal Year	
Imports:	1914	1915	1913–1914	1914–1915
Zinc dust	174	24	2,404	1,439
Exports:				
Zinc dust	.....	21	66	275
Zinc dross	.....	562	286	5,181

The exports of zinc dust were all reëxports of foreign material.

The movement of zinc ores for June and the fiscal year was as follows:

	June		Fiscal Year	
	1914	1915	1913–1914	1914–1915
Exports, tons, contents not given	1,431	.....	14,294	3,345
Imports, tons	2,136	19,175	18,280	79,814
Zinc contents, lb.	1,399,921	15,121,176	14,484,802	66,649,820

In 1913-14 reëxports of foreign ore having zinc contents of 1,184,629 lb. were made. In 1914-15 no such reëxports are given in the returns.

Lake Shipping Conditions

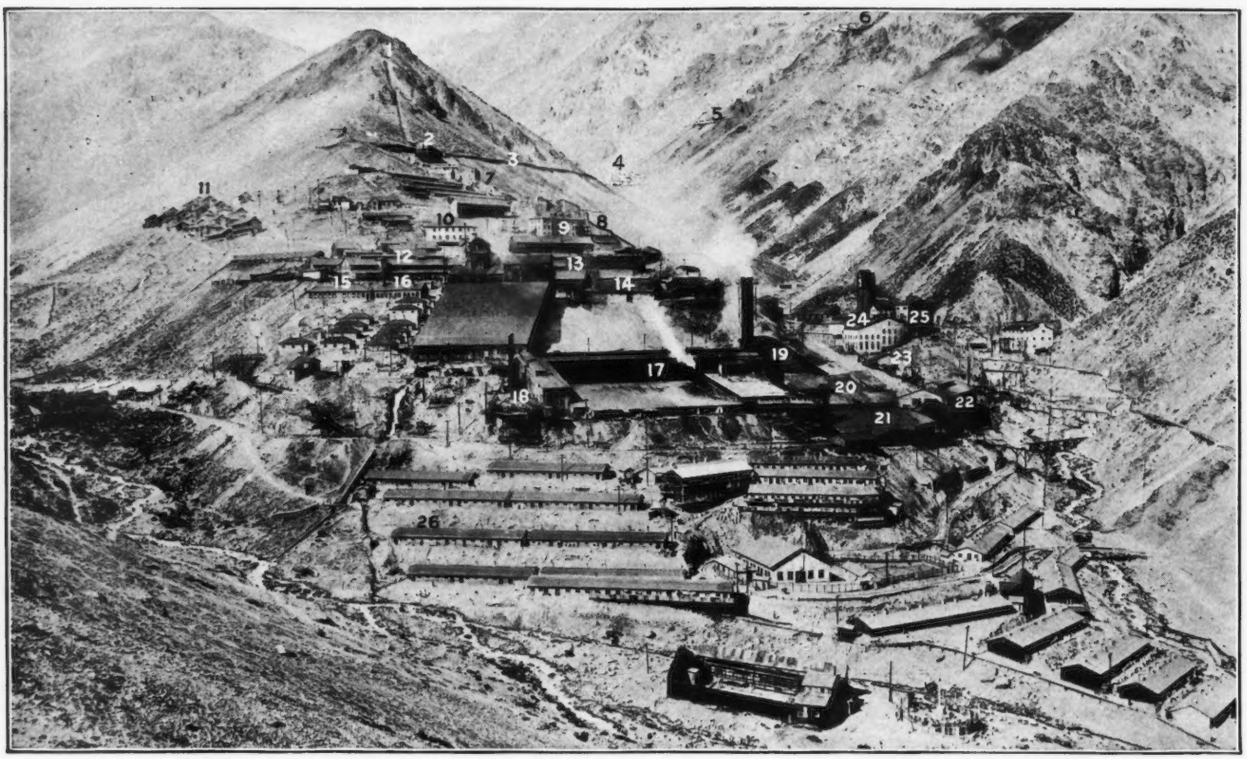
For the first time since 1907 iron-ore shippers are now canvassing the vessel owners and offering ore-carrying contracts. In fact, several instances have been noted where carriers have refused contracts, preferring to take wild cargoes until later. Vesselmen complain that the present season has been an unprofitable one because of low rates. They say that in the past, when a dull season wound up with a rush, as at present, it indicated a prosperous year to follow, hence their reluctance to contract until the rush is at its height. The ship owners could take more ore if it were not for the fact that they anticipate only a moderate coal movement up the lakes this fall. At the present rates on ore it is only profitable to carry coal one way and ore the other. Grain is another factor counteracting against the ore trade. Brokers are bidding 2½c. for boats for grain at Duluth or Fort William for Lake Erie ports. This rate is theoretically equivalent to 93⅓c. on ore, and in actual practice about 75c., as against the nominal iron-ore rate of 50c.

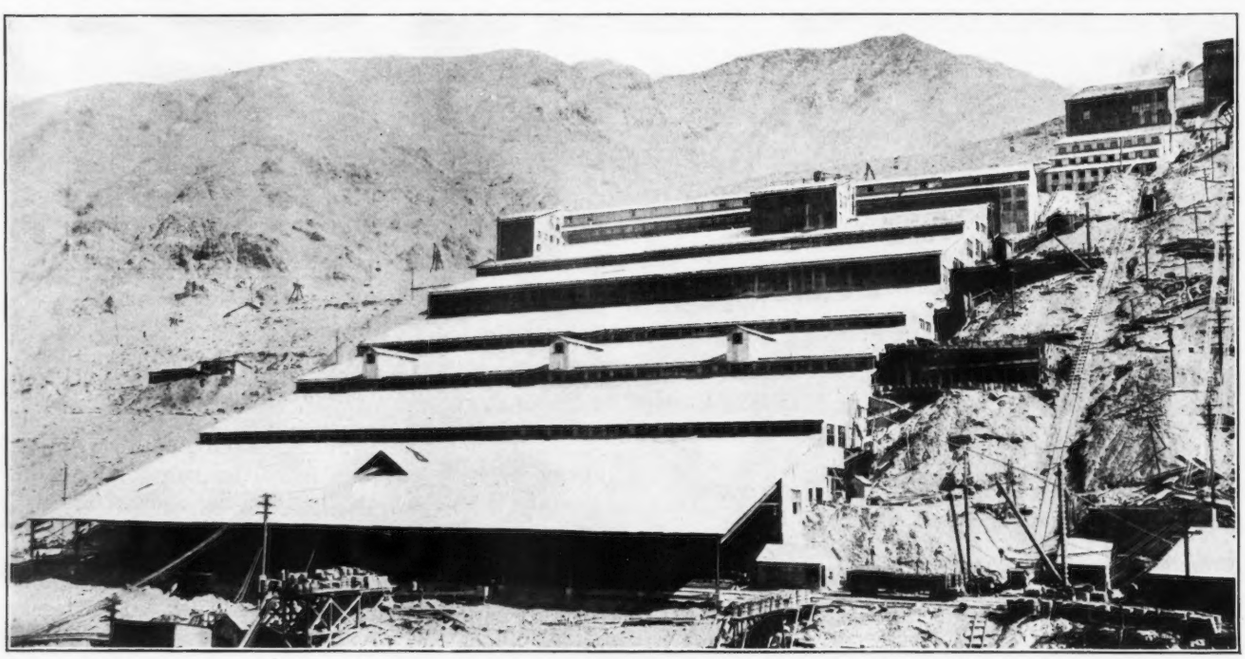
Vannoy H. Manning

Vannoy H. Manning, the new Director of the Bureau of Mines, was born at Horn Lake Depot, Miss., Dec. 15, 1861. For more than 20 years he has been engaged in technical and scientific work in the Department of the Interior. From 1885 to 1910, as civil engineer with the United States Geological Survey, he was engaged in topographic mapping in nearly every state of the Union. When the Bureau of Mines was established in 1910, Mr. Manning was appointed to an administrative position in it by Secretary Ballinger, and on Jan. 1, 1911, was made Assistant Director; he has been Acting Director of the bureau in immediate charge of its work since Jan. 1, 1914, at which time Doctor Holmes, on account of illness, had to relinquish active work. During his service with the bureau Mr. Manning has had charge of methods relating to appointments, expenditures and the conduct of investigations, loyally supporting Dr. Holmes in every effort to make the bureau of greater service to the public, and by handling a mass of detail enabling Dr. Holmes to give attention to matters of policy and to the coördination of the work of the bureau with that of other Government and private institutions or establishments seeking to increase safety and efficiency in the mining, quarrying and metallurgical industries. Since June 1, 1914, Mr. Manning has had charge of all the technological investigations being conducted by the bureau, of the operation of its mine-rescue cars and stations, and of the educational work of safety and health that the bureau is doing in the mining and metallurgical districts of the United States.

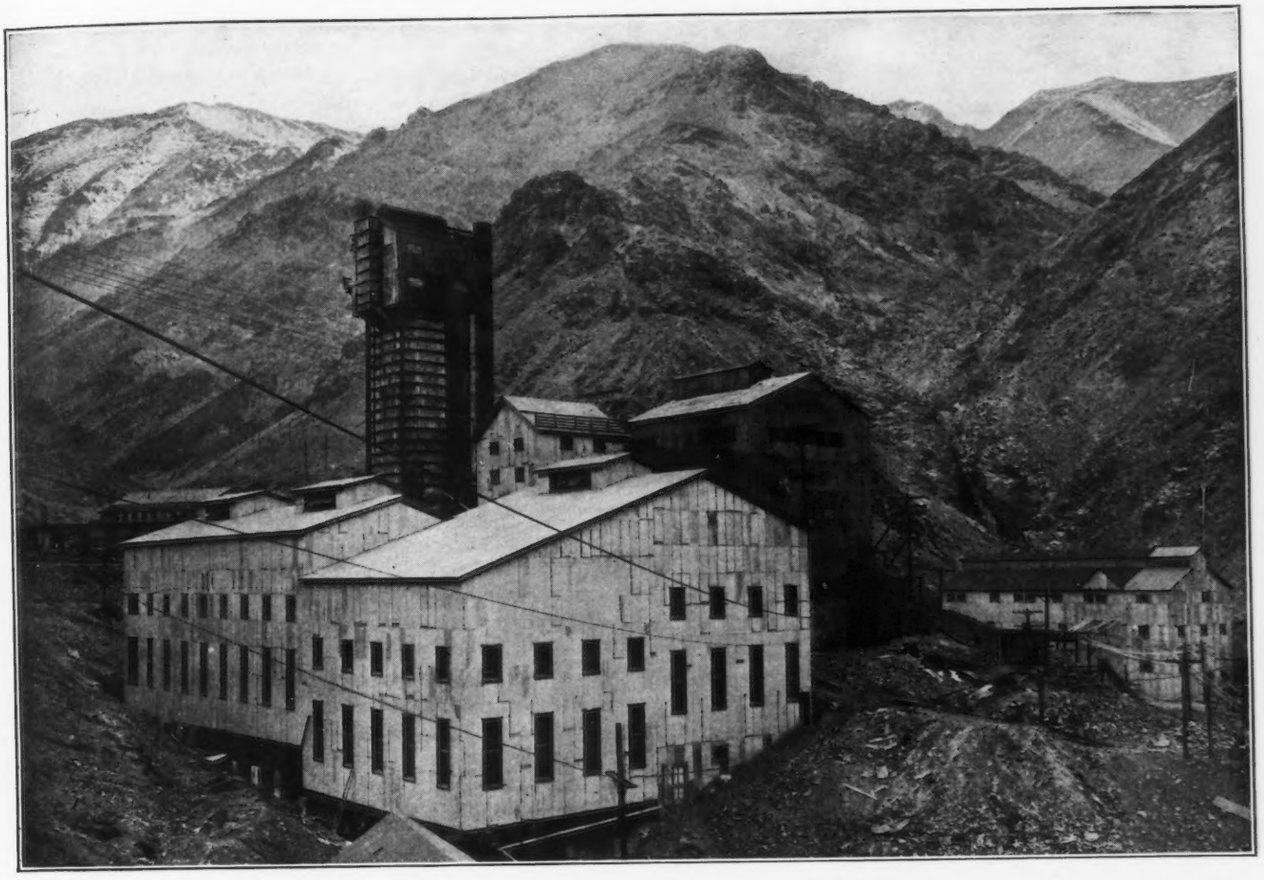
VANNOY H. MANNING

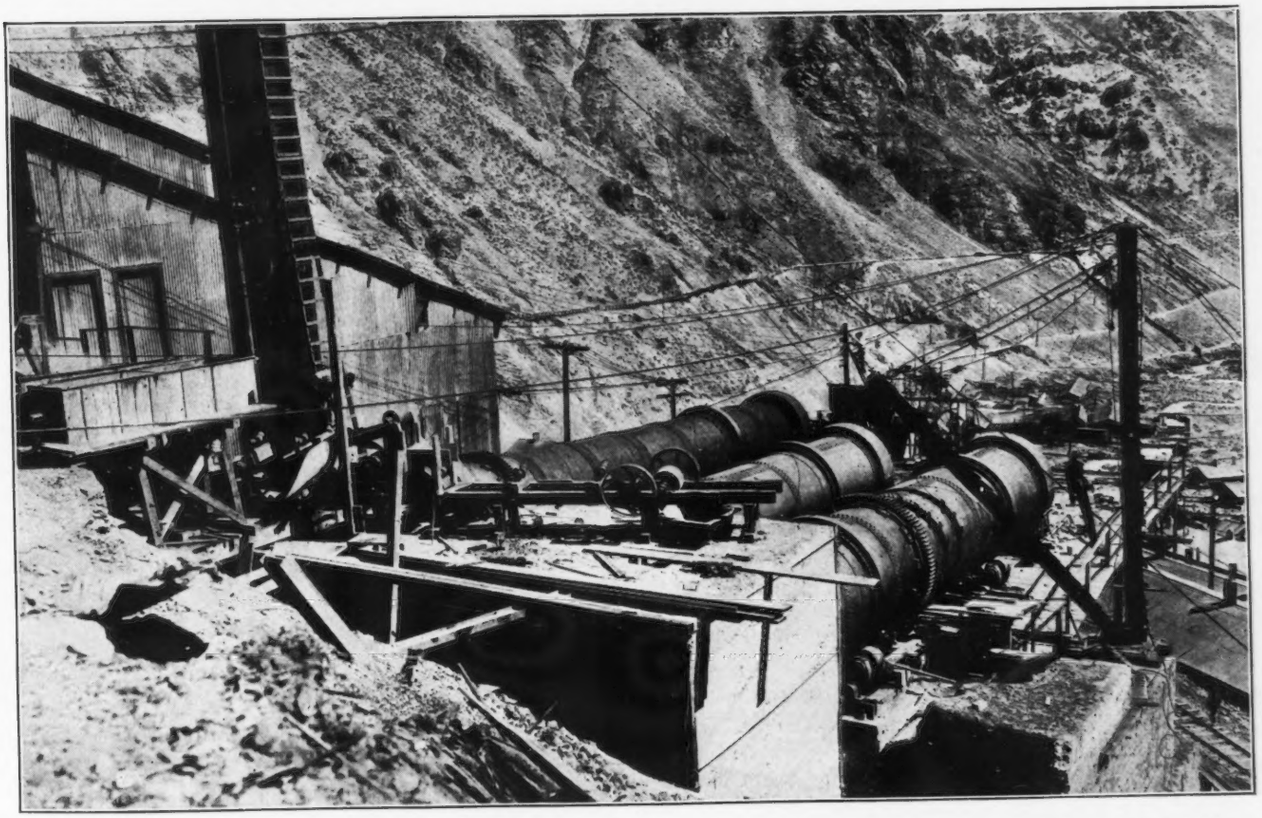
Braden Works, Sewell, Chile





The upper view shows the Braden Copper Co.'s reduction works at Sewell, Chile. The name of the town was formerly Molino, but was changed to Sewell in March, 1915, in memory of the late president, Barton Sewell. The mines are about 1½ miles up Teniente Cañon at the right. The chief features of interest in Sewell are: 1, penstock and high-pressure water line; 2, coarse-ore bins; 3, electric railroad to mine; 4, 5, 6, adits of Teniente mine; 7, crushing plant; 8, mill; 9, staff house; 10, main office; 11, American townsite; 12, store and warehouse; 13, mechanical shops; 14, foundry; 15, laundry; 16, laboratory; 17, smeltery charge bins; 18, nodulizing cylinders; 19, dust chambers; 20, blast-furnace building; 21, converter plant; 22, electrolytic building; 23, leaching plant; 24, sulphuric-acid plant; 25, roasting plant; 26, native quarters and town. Farther up the hill, near the staff house, a modern hospital has been provided. The lower illustration is a closer view of the mill, which employs both gravity and flotation concentration.





The upper view shows the sulphuric-acid plant which supplies acid for the flotation process and for the leaching experiments. The lower view shows the nodulizing cylinders in which the flotation concentrates are agglomerated to make them suitable for blast-furnace charging.

Manganiferous Iron Ores of the Cuyuna Range

By Edward P. McCarty*

SYNOPSIS—Orebodies occur lens-shaped averaging 200 ft. wide on the North Range and 125 ft. on the South Range. North Range ores are manganiferous, the South Range ores are not. Ores are of secondary origin. A small tonnage is low in phosphorus. A large tonnage is high-phosphorus and can now only be used in mixtures to make pig iron. Beneficiation is difficult and mechanical washing and concentrating tests thus far show only indifferent results. Magnetic separation would reduce phosphorus but could not separate iron and manganese.

The iron and manganese orebodies of the Cuyuna range, Minnesota, are irregular in form though usually lens-shaped. Both iron and manganese occur within the same lens. These lenses may be broad, narrow, single or double, and often parallel, separated by lean ore material or barren rock. They stand at steep dips.

As to size great variation is to be noted. The ore-bearing formation without doubt is continuous for many miles, but the length of a single lens is not great. The lenses of ore have a tendency to overlap. A rapid change in the formation may cause the pinching out of a lens. Irregularities in the shape of the lens may make it appear as though the lens had pinched out. This may be due to the pitching trough. Underground development alone will show actual conditions. On the North Range the greatest width of lens does not exceed in all probability 500 ft. The average will be much less, not exceeding 200 ft. On the South Range 125 ft. is nearer the maximum width with an average of about 50 ft. It is not likely that commercial ore will be found extending to a great depth since ore concentration has taken place from the top down. Perhaps 450 ft. deep for the North Range and 300 ft. deep for the South Range would be a fair estimate for the average depth of merchantable ore, having in mind the iron ore rather than the manganiferous ore.

The Cuyuna iron ores are mostly hydrated hematites of a red, brown, and black color, and in some cases earthy in character. The ores show high loss on ignition. This is owing to the driving off of the water of crystallization and the decomposition of carbonates that may be present. Such ores smelt readily. Some of the ores are true hematites, especially the North Range deposits. The brown and black ores are characteristic of the South Range and are somewhat magnetic.

Manganiferous Ores of the North Range

The North Range contains areas of highly manganiferous ores so far lacking in the South Range. The iron content of this ore averages about 55%. On the South Range it is almost an invariable rule that the highest percentage of iron is found in the ore near the surface and the iron content decreases with increased depth. This is also true, to a certain extent, on the North Range. Siliceous material is present in considerable quantities. Where the iron runs high the silica runs low and vice versa. With increased depth the silica rapidly increases until the ore becomes too lean to be merchantable. The average phosphorus content is high, about 0.30%. Present developments show a bessemer iron orebody in only one 80-acre tract. The alumina averages well for merchantable ore, although the ores are slaty in places; little or no paint rock occurs. The manganese presents an interesting phase relative to the ores of the district.

On the North Range there exist orebodies carrying 25% manganese for part of a drill hole while the rest of the hole may show little or no manganese. Many drill holes average from 6 to 15% manganese, while a short distance from the hole the orebody shows very little manganese. As a rule it follows the iron in a high percentage near the surface, decreasing with depth. In the general run of bodies the manganese will be less than 1%. In certain cases development shows a higher percentage of manganese than that indicated by drill holes. As usual with manganese minerals the ore formation is spotty.

The moisture content of the ores varies from 6 to 14% with an average of about 12%. The shape of the orebodies and their relation to the adjacent rocks exclude the idea of their being contemporaneous with the enclosing rock. Their occurrence near the erosion surface indicates a secondary development in the nature of a concentration by meteoric waters. Iron carbonate was undoubtedly present in the original iron-bearing rocks. The Cuyuna orebodies therefore may contain some iron carbonate where the weathering has been incomplete.

The manganiferous ores of the Cuyuna Range may be classified into: (1) Low-phosphorus manganiferous iron ore, and (2) high-phosphorus manganiferous iron ore.

The first class is made up of a small tonnage of manganiferous ore low in phosphorus; that is, an ore which is sufficiently high in manganese and of a character suitable for the manufacture of spiegeleisen—the alloy used for recarburizing in the bessemer process and to some slight extent in the open hearth. Such ore is found in one of the operating mines and to a small extent elsewhere. The analysis is variable, but may be taken at: Iron 44.25%; phosphorus .036%; manganese 10.50%; silica 18.25%; moisture 9.55%. Its tonnage, however, is small. The layers containing this low-phosphorus manganiferous iron ore will ultimately run into stringers of material containing so much phosphorus as to cause the orebody to pass into the high-phosphorus manganiferous iron ore.

High-Phosphorus Ores

The second class consists of a considerable tonnage of high-phosphorus manganiferous iron ore. It is difficult to give to this class an average grade, but the table on the following page gives some representative analyses.

*Professor of mining, University of Minnesota.

It is at once apparent that such ores would have their only use in mixture with other ores in the manufacture of pig iron, where the regular mixture does not carry sufficient manganese. The present tendency of steel makers is to increase the manganese charge in their ores. The presence of 1% manganese is desirable in basic iron on account of the beneficial effects which this element has with respect to sulphur. Many ores do not contain sufficient manganese to make an iron containing as high as 1%. The ores carrying from 15 to 16% manganese

ANALYSES BY PER CENT., DRY WEIGHT

Iron	Phosphorus	Manganese	Silica	Alumina
46.85	0.239	6.84	4.80	3.66
48.39	0.314	7.02	6.07	2.35
40.85	0.273	15.24	3.21	2.91
38.74	0.262	16.23	3.21	2.91
51.16	0.288	6.61	6.07	2.35

could be used in making spiegeleisen, if the phosphorus percentage was not so high. Spiegeleisen must contain less than $\frac{1}{10}$ of 1% in phosphorus. If these ores were smelted directly without any previous treatment, the resulting product would be a high-phosphorus spiegeleisen, varying in manganese from about 10%, for the low-manganese ores, to about 22% for the higher-manganese ores.

In the smelting of manganiferous iron ores, it is found that about three-fourths of the manganese will go into the metal and one-fourth into the slag. All the phosphorus, unfortunately, will remain with the metal. Owing to the high phosphorus of these ores they are unsuitable for spiegeleisen, and on account of the phosphorus content, they would naturally be graded as foundry ores, except that the high manganese precludes the use of such ores for foundry purposes.

Unmerchantable Low-Grade Ores

Owing to the low iron content these ores are not of merchantable grade at this time, even if the phosphorus and the manganese were in such percentages as to admit of their use as foundry ores or steel-making ores; such ores could not be used in a furnace on a basis of 100% of the charge on account of excess manganese.

According to Ledubur, an ore of the following composition is smelted in the Queen Mary steel plant in Germany: Iron oxide 39.30%; manganese 10.48%; silica 21.92%; alumina 11.84%; lime 0.27%; magnesia 1.19%; sulphur 0.04%; phosphorus 0.68%; loss on ignition 9.00%. This ore is a siderite containing high alumina and was, for the most part originally limonite, ultimately decomposed into a siderite. Little of such ore, however, has been utilized. It is to be noted that the composition of this ore is much like that covered in this class found on the Cuyuna Range. It is not to be confounded under any conditions with the class of ores called in the trade "manganese ores." Such manganese ores contain from 40 to 52% in manganese. Phosphorus analyzes from .01 to .05%. The iron percentage varies from 2 to 14. Manganese ore with percentages such as these is marketed in various parts of the world. It is to be noted that the percentage of phosphorus is low and the percentage of manganese high.

In England an iron carbonate is used. It is usually roasted before smelting. A typical analysis is as follows: Iron oxide 36.14%; manganese 1.12%; silica 10.17%; alumina 4.80%; lime 0.76%; magnesia 0.94%; sulphur 0.04%; phosphorus 0.33%; moisture 2.52%. From the above analysis it is at once seen that the phosphorus is practically the same as that carried by the Cuyuna Range ore, but the iron is in the form of a siderite and in no wise directly comparable with the Cuyuna ore.

Problem of Beneficiation

Since the high phosphorus manganiferous ore cannot be smelted and treated at a profit without prior beneficiation, the question at once arises, How may such beneficiation be done? By beneficiation is meant the increasing of the iron and manganese content or the purifying of the mass by the removal of the phosphorus, silica, sulphur, etc. Beneficiation along metallurgical lines does not offer an inviting field. Hence resort must be had to some mechanical treatment of the ore. Such ore might be screen-sized, classified, washed in a log washer, jigged, treated on reciprocating tables or magnetically concentrated. Tests made so far have shown only indifferent results.

Magnetic concentration might aid in reducing the phosphorus content, but cannot separate iron and manganese. The phosphorus may exist in an iron ore, or manganiferous iron ore, as on the Cuyuna Range, in the form of several minerals, principally apatite ($CaFCl.Ca_4P_3O_{12}$) and vivianite ($Fe_3P_2O_{8}.8H_2O$). In New York, operating on a magnetic ore—note the Cuyuna ore is a hematite—by fine grinding and magnetically concentrating the product, commercial apatite is formed as a byproduct and a nonbessemer ore rendered bessemer. In the Cuyuna ores the phosphorus exists in the form of apatite in part only, crystals of apatite have been found, but the percentage of phosphorus is greatly in excess of that carried by the apatite. It is a fair assumption that much of the phosphorus is in the form of vivianite or similar minerals. When thus combined, the iron and phosphorus cannot be separated magnetically.

Present indications are not favorable to beneficiating Cuyuna ore by magnetic concentration alone.

Tonnages Developed

The tonnages and grade of high-phosphorus manganiferous ore so far developed on the Cuyuna Range is as follows:

ANALYSES BY PER CENT., DRY WEIGHT

Tons	Iron	Phosphorus	Manganese	Iron and Manganese
123,771	54.65	0.179	1.22	55.87
3,122,031	56.38	0.159	1.36	57.74
720,488	53.69	0.258	3.53	57.22
644,750	50.85	0.350	4.98	55.83
713,490	49.15	0.336	5.90	55.05
468,566	47.27	0.058	9.19	56.46
948,802	46.46	0.236	10.99	57.45
1,939,417	42.57	0.226	11.30	53.87
408,878	39.27	0.090	15.45	54.72
183,716	43 26	0.156	15.96	59.22
100,000	30.82	0.070	21.93	52.75

The total as shown above amounts to 9,373,909 tons of such ore. Without question further drilling will increase this tonnage, but the fact remains that the general character of such ore has been established and the value, whether materially increased or not, is practically settled. Many erroneous statements have been made at different times relative to these manganiferous ores, and until recently a correct knowledge of them had not been acquired.

Nothing has been said about ferromanganese which was of such interest a few months since. There is no ore on the Cuyuna Range from which ferromanganese may be manufactured. A small tonnage of spiegeleisen can be produced.

It should be borne in mind that the consumption of ferromanganese is increasing in the United States, as the making of openhearth steel increases, while the use of spiegeleisen is decreasing as its principal role is that of a recarburizing agent in the bessemer process of steel manufacture.

The Minnesota School of Mines Experiment Station has in press a bulletin entitled "Preliminary Concentration Tests on Cuyuna Ores." This publication takes up the treatment of the ores with considerable detail and deals especially with log washing and jigging tests. A chapter is devoted to the manganiferous ores.

Draining a Swamp by Air Lifts

SPECIAL CORRESPONDENCE

At the American mine, Diorite, Mich., J. R. Thompson, manager and part owner, has devised a novel method for removing the water from a large swamp which lies above some of the mine's ore deposits. The swamp is about 2 mi. in length and 1 mi. in width, containing a great deal of water, and it was feared that if it ever came into the workings in large quantities it would cause trouble. To get rid of the water was considered quite a problem, but Mr. Thompson did some figuring and believed that he could solve it. He had a diamond-drill company put down several holes in the swamp, to find how close the ledge was to surface, which would give some idea of the amount of water that the swamp held. The drills showed that the ledge varied from about 70 to 125 ft. below surface. On top there was about 10 ft. of black muck, with quicksand and gravel below. The diamond-drill firm was asked to put down several 8-in. holes to the gravel, but its engineer stated that the task would be too great, as the quicksand would cause difficulties. Mr. Thompson then undertook the work himself, putting down the first pipe a distance of 76 ft. in three days after the tripod was rigged up. The pipe was not touched with a hammer. It was sunk by turning, forcing air down the inside at the same time. When the pipe was bottomed in the gravel the air caused the water to shoot to surface. This pipe is now producing about 1000 gal. per min. Since that time five more pipes have been put down, some of them reaching a depth of over 100 ft. One went through the gravel, being put down deeper than any of the others, and no water is now flowing from it. An attempt was made to blast it off higher up, but without success. One of the other pipes is also inactive. The four that are now working are sending about 5000 gal. per min. to surface. Two of the pipes are 10 in. in diameter, but they do not give any better results than the 8-in. pipes. This system of an air-lift has lowered the water level in that huge swamp over 20 ft. during the short time that it has been in operation. When most of the water is out, a drift will be extended from the 140-ft. level of the mine and a 3500-gal. centrifugal pump installed to care for any water that comes into the swamp later on. The method is very cheap, as the pipes need no attention after they get in operation. Some idea of the force of the water can be gained from the fact that granite rocks weighing as much as 8⅝ lb. were brought to surface through one of the pipes. The water coming from below runs into a ditch that was made by using dynamite and forms quite a sizable stream. The principal of the air-lift is quite old, but we do not know that it has ever been applied to this kind of work before.

Bureau of Mines Suggested Regulations for Mines

A publication of considerable interest to the metal-mining districts of the United States has just been issued by the Bureau of Mines, under the title, "Rules and Regulations for Metal Mines." It is to be known as Bulletin 75 and the authors are W. R. Ingalls, J. Parke Channing, James Douglas, James R. Finlay, and John Hays Hammond.

The above committee was originally appointed at a meeting of the American Mining Congress at Denver, Colo., in November, 1906, and its object was the drafting of a modern law governing quarrying and metalliferous mining which could be recommended to the several states for adoption, in the hope that the passage of such a uniform law by the mining states would tend to lower the number of fatal and serious accidents.

When the committee took up its work, it found that Colorado, Missouri, Montana and New York were the only states that had enacted mining laws of broad scope applicable to other than coal mines. California, Arizona, Idaho, Kansas, Michigan, Minnesota, Nevada, New Mexico, North Carolina, Oregon, South Dakota, Tennessee, Utah, Washington, and Wyoming were found to have statutes pertaining to metalliferous mining, but with few and incomplete safety provisions.

This committee of the American Mining Congress did considerable work along this line and made a number of reports. In April, 1911, Dr. Joseph A. Holmes, Director of the Bureau of Mines, invited the committee to serve as a committee of that bureau with the idea of preparing a final draft of a law, and this invitation was accepted.

Starting with a composite of existing laws, the committee by successive stages endeavored to work out a general law that would embody the best mining thought of the day, be in accord with approved modern mining practices, and yet at the same time be effective and practical in operation, not merely a collection of rules and regulations to be disregarded or enforced at will. The committee in discussing its report says:

"We have found that a great deal of interest and attention among mine operators has been awakened by our advocacy of improved means for promoting safety in mining. However, we are under no illusion that our recommendations will be immediately and generally adopted. We consider our work to be especially of aducational character rather than anything else. It will be useful in three main ways, we think, as follows:

"1. As a basis for State legislation.

"2. As a basis for private systems of inspection.

"3. As a collection of simple rules for the guidance of everybody engaged in mining.

"Since the publication of our first report several States have adopted new mining laws and amended their old ones. In this connection our code has served some purpose; for example, in the drafting of the laws that now stand on the books of the states of Nevada and Arizona. We do not expect that any state will at once adopt all of our recommendations, especially those that are essentially of legal character. We offer them as what we think ought to be and hope some day will be.

"Since our first publication, furthermore, most of the mining companies of consequence have adopted inspection systems or have at least framed codes of safety rules, which have been based to a large extent on our code, notably so in the case of the Cleveland-Cliffs Iron Co. This tendency, in fact, has become one of the most important phases in the national movement for 'Safety First.' This is the gratifying consummation that we had in mind. Unquestionably, also, the widespread adoption of state laws providing compensation for injured workmen has helped the safety movement by making accident prevention worth while.

"We consider, however, that the chief usefulness of the code of rules that we have formulated will be to small operators, who frequently engage in unsafe practices without knowing that they are unsafe or without thinking about the matter at all. There is a reasonable hope that our report will be of educational value to all mining operators.

"The act that we have drafted may be regarded from two angles—from the legal and from the technical. With respect to the latter we have had in mind the conditions and practice of mining existing and prevailing in the several parts of the United States. In our treatment of the matter from the legal standpoint, in which we have had the advice of good lawyers, we have refused to clothe the inspector of mines with the optional powers that are given to him under the laws of many of the British colonies, and also we have refused to convey to him the sweeping power that is given to health inspectors in some of our own states.

"The code of mining rules that has been finally drafted by the committee is the coördination of the experiences, opinions, and suggestions of a great many men who have been associated with the committee in an advisory capacity and as directly employed aids. The former have included many engineers actively engaged in practice, members of professional societies, and members of the bar; the latter have included members of the regular staff of the Bureau of Mines and of the personal staffs of members of the committee. The committee has sought to obtain many points of view and to summarize many experiences. The draft that has been prepared is not offered as the last word upon this subject. There are many phases of this subject with which the committee has been unable to deal thoroughly. Thus the committee confesses its inability to formulate at the present time adequate rules covering the important subject of ventilation of mines. Similarly there are many practices in opencut mining, by steam shovels, etc., regarding which the committee has felt unable to formulate rules. We feel, however, that the rules so far as prescribed may advantageously be applied to open mining whether it be simple quarrying or the extraction of metalliferous mineral, as well as to underground mining."

Lake Superior Mining Institute

The twentieth annual meeting of the Lake Superior Mining Institute will be held on Sept. 6, 7 and 8, 1915, assembling at Ishpeming, Mich.

A first-aid contest will be held Monday morning, Sept. 6. In the afternoon automobiles will be taken for a trip over the range, visiting the following mines: Norrie Group, Newport, Colby and Wakefield. The Wakefield is the new property opened by the M. A. Hanna Co. and is described in a paper by W. C. Hart. Stops will also be made at other mines en route. A business session will be held at the New Central High School at 7:45 p.m. Trains will leave for the Cuyuna at 11 p.m., arriving at Crosby, Minn., at 7:30 a.m. Breakfast will be served on the dining cars from 6 a.m. Cars will be provided to take the party to the following mines: Croft, Thompson, Armour No. 1 and No. 2, Kennedy, Pennington, Mahnomen, Mille Lacs, Iron Mountain, Sultana and Hill Crest. This is the first visit of the Institute to the Cuyuna Range. Another business session will be held in the evening, and trains will leave for Minneapolis at 11 p.m.

On Wednesday the party will be met at the train by a special committee of the Minneapolis Civic and Commerce Association. Automobiles will be provided for a visit to the Minnesota School of Mines. Luncheon will be served at the Minnikahda Club at 1 p.m. and after luncheon the party will visit the State Fair.

Following is a partial list of papers to be presented during the meeting: "Sheet-Ground Mining in the Joplin District, Missouri," by Edwin Higgins, mining engineer, Bureau of Mines, Ironwood, Mich.; "Rock-Drifting in the Morris-Lloyd Mine, Marquette Range," by J. E. Hayden, mining engineer, Ishpeming, Mich.; "Sinking of the Woodbury Shaft at the Newport Mine, Gogebic Range," by J. M. Broan, mining engineer, Ironwood, Mich.; "Mining Methods on the Gogebic Range," by Messrs. Oscar Olson, Frank Blackwell, O. M. Schaus, Committee; "A Survey of the Developments and Operations in the Cuyuna Iron Ore District of Minnesota," by Carl Zapffe, geologist, Brainerd, Minn.; "The Mining School of the Cleveland-Cliffs Iron Co.," by C. S. Stevenson, director, educational department, Ishpeming, Mich.; "Grouting at the Francis Mine Shaft of the Cleveland-Cliffs Iron Co.," by John R. Reigart, assistant superintendent, Princeton, Mich.; "New Stock-Pile Trestle, Colby Iron Mining Co.," by G. S. Barber, superintendent, Bessemer, Mich.; "Opening of the Wakefield Mine," by W. C. Hart, superintendent, Wakefield, Mich.; "The Use of Gunite in a Steel Shaft and in an Underground Pump-House on the Gogebic Range," by Steven Royce, general engineer, Hurley, Wis.

Cuyuna Range Tonnage for 1915

BRAINERD CORRESPONDENCE

Under present expectations the Cuyuna Range will ship 1,075,000 tons in the 1915 season. This estimate is based on announced ore sales and other definite factors. Of this tonnage the Soo Line will haul fully 80%, the remainder going via the Northern Pacific. Detailed tabulation is as follows:

	Expected Tonnage	Maximum
*Armour No. 1	75,000	75,000
*Armour No. 2	200,000	250,000
Adams	.....	.....
Barrows	.....	.....
Brainerd-Cuyuna	.....	2,000
Croft	.....	.....
Cuyuna-Mille Lacs	40,000	50,000
Cuyuna-Duluth	.....	10,000
Hill Crest	.....	.....
*Iron Mountain	10,000	10,000
†Kennedy	200,000	225,000
Mahnomen	.....	10,000
*Meacham	.....	.....
*Pennington	100,000	100,000
*Rowe	200,000	300,000
Rowley	.....	.....
Sultana	.....	2,000
*Thompson	200,000	200,000
Wilcox	50,000	60,000
	1,075,000	1,294,000

*Ships via Soo Line. †One-half tonnage to the Soo and one-half to the Northern Pacific. The remainder ship via Northern Pacific or are not tied up.

Electrical Power for the Cuyuna Range

BRAINERD CORRESPONDENCE

The Cuyuna Range is supplied with hydro-electric power by the Cuyuna Range Power Co., whose power plant is located on the Crow Wing River southwest of Brainerd. A large proportion of the underground pumping is done electrically, although operators have found it necessary to safeguard themselves by the installation of auxiliary steam pumping plants. The Wilcox mine, at Woodrow on the South Range, has perhaps the best equipment in this respect. Here the pumping facilities consist of one 1200-gal. two-stage electric station pump (100-hp. motor), one 800-gal. four-stage electric sinking pump (65-hp. motor) as an auxiliary, and a small electric pump for boiler feed, etc. A like capacity of simple and compound, noncondensing steam pumps is carried for emergency purposes only. Air for drilling is compressed by a 100-hp. electrically driven machine. The remainder of the plant is steam, two 150-

hp. boilers furnishing power for hoisting and for operating the auxiliary pumps. At the Rowe mine, Riverton, electrically operated pumps have served admirably in furnishing water for the hydraulicking operations, which are now practically completed.

English and Canadian Tough Oakes Companies

SPECIAL CORRESPONDENCE

The Tough Oakes Co. in Kirkland Lake, which has received so much publicity on account of the financial mazes through which its promoters have carried it, is again in the limelight because of an endeavor to have the English company liquidated.

There are two companies of the same name, one English and the other Canadian, the former having contracted to purchase the stock of the Canadian company through the agency of the Kirkland Lake Proprietary, which is also an English company. The Proprietary and the English Tough Oakes were promoted by the same people, and in the process of transferring the stock a substantial commission was obtained by the Proprietary company.

The English Tough Oakes Co. sold stock to the extent of £200,000, and of this amount only £45,000 was paid to the Canadian company. The balance of £155,000 was practically all loaned to several companies in which the promoters of the English company and the Proprietary held control, and the stock of these various companies was given as security for the loans. After the war broke out it was impossible for the English company to realize on any of these securities—some of which did not have anything very substantial behind them—so that the contracts with the Canadian company could not be carried out. A petition was presented in the English courts asking for the winding up of the English Tough Oakes Co., and this petition was supported by holders of 20,500 shares, while those opposing the petition represented 155,000 shares.

The judge ordered the petition to stand over pending the hearings of the actions in the Kings Bench Division, and also ordered the company to use its best endeavors to collect the moneys owing.

College Teams in a National First-Aid Meet

In view of the great interest manifested by first-aid teams from mining colleges in the third annual joint field meet to be held in San Francisco, Sept. 23 and 24, by the United States Bureau of Mines, the American Mine Safety Association and the California Metal Producers' Association, the rules committee has withdrawn the restrictions against the participation of such teams in the meet.

The ruling previously made that only teams from bona-fide mining, smelting and milling companies should be admitted to the interstate contests of Sept. 24, hereby restricting teams from mining colleges to participation in the demonstrations of Sept. 23, has been modified to provide that such teams and teams from state departments or other institutions interested in safety in mining, but not concerned in mine operation, may compete among themselves on the 24th for a special prize for the most proficient team from an educational institution.

Freeman's Appeal Wins New Trial

The United States Circuit Court of Appeals handed down a decision reversing the judgment of the trial court in the case of Albert Freeman, who, with Julian Hawthorne and Dr. William J. Morton, was convicted of using the mails in a scheme to defraud investors in mining stocks, and sentenced to serve a term of five years' imprisonment in the Atlanta penitentiary. In reversing the judgment the Appellate Court orders a new trial for Freeman.

Hawthorne and Doctor Morton did not appeal, and since the trial they have served their sentences.

The appeal was granted on the ground that two different judges could not hear the same case. While the trial of Freeman, Hawthorne, and Doctor Morton was under way in the Criminal Branch of the Federal District Court, Judge Charles M. Hough, who was presiding, was taken suddenly ill, and then, in accordance with a stipulation entered into by District Attorney Marshall for the Government and counsel for the defendants, the trial was continued and finished before Judge Julius M. Mayer.

Later, on a motion, irregularities concerning the jury were brought to Judge Mayer's notice.

Freeman was convicted in March, 1912, and in asking for a new trial asserted that one of the trial jurors was disqualified because as a Grand Juror he had previously investigated the Hawthorne Silver & Iron Mining enterprises. Freeman further asserted that three of his witnesses were intimidated and threatened with prosecution if they crossed the Canadian border to swear to the accuracy of their reports which were used in the sale of mining stock.

Gold and Silver Production in 1914

The revised statement of the Director of the Mint shows that the production of gold and silver in the United States during 1914 was actually considerably in excess of the preliminary estimate published last January. The production of the precious metals in 1914 therefore compares with that of 1913 as follows:

	1913	1914	Changes
Gold, value	$88,884,400	$94,531,800	I. $5,647,400
Silver, fine oz.	66,807,500	72,455,100	I. 5,653,600

The corrected totals exceed the earlier estimate for 1914 by $1,708,300 gold and 4,525,400 oz. fine silver. The approximate value of the silver produced in 1914 was $39,713,365, at the average price of the year.

Bureau of Mines Car Schedule

The Bureau of Mines Denver Car No. 2, J. H. East in charge, will follow the following schedule for the next 10 days:

	Arrive	Leave
Bisbee, Ariz.	Sept. 5	Sept. 7
Clifton, Ariz.	Sept. 7	Sept. 9
Globe, Ariz.	Sept. 9	Sept. 11
Los Angeles, Calif.	Sept. 12	Sept. 13
San Francisco, Calif.	Sept. 14	.....

The Shawinigan Electro-Products Co., Baltimore, Md., will erect a plant for the manufacture of calcium carbide, according to report.

Editorials

Mining-Stock Brokers

The spirit of speculation that has once more overtaken our people is naturally developing an activity in the mining-stock exchanges of New York and the interior, or the semblance of such. Already there are reports of scandals and of operations that are attracting the attention of the authorities. The latter should be on the alert, else the work they did in cleaning up the criminal dirt that accumulated during the boom of 1906-7 and soon afterward will be undone.

Now let us have a clear understanding of what the conditions are. Almost all branches of business are speculative, mining being so neither more nor less than any other. Utah Copper Co., for example, exemplifies an enterprise in which millions of money were expended in developing a huge deposit of copper ore. During the development period there was speculation as to how large the ore deposit would prove, whether the estimates of grade would be verified, whether unforeseen difficulties in the extraction and beneficiation of the ore would crop out, etc. There were violent controversies over some of those matters. After the lapse of nearly 10 years the disputes have disappeared, the position of Utah has been established, investment in its shares has come to be regarded as safer than investment in New York City real estate. Yet there is still speculation in them. The market for copper, the policy of the management, the possibilities of progress in the arts of mining and metallurgy—all constitute factors that affect value and afford opportunity for speculation than which nothing is more legitimate.

Another kind of speculation in mining is equally legitimate and is indeed the mainstay of the mining industry. This is the venturing of capital in looking for mines, in making mines. In this the chances for loss are greatest and conversely the chances for big returns are correspondingly large. Such speculation is usually undertaken privately by a small group of persons, or by a larger group through the medium of an exploration company. The public is seldom invited to participate, nor should it be, and there is no need for the listing of stock upon an exchange. When a mine has been brought to some degree of success its shares become more and more distributed. Private trading is followed naturally by public trading on the curb, and finally the stock goes upon the New York Stock Exchange, the great market of the country.

To this legitimate business in mining the so-called "business" on the minor exchanges bears about the same relation that the betting ring of a race course does to a trading place for commodities. The prime function of those exchanges is the gambling in things that do not mean anything, in pieces of paper, in mere names. Almost everywhere in the United States the faro bank, the roulette wheel, the pool room have been exterminated. The managers of the "mining-stock exchanges" say that they are doing "business," their dealers and lookouts and cappers call themselves brokers and the police are impotent against them. Recently the brokers of the exchange in Salt Lake City suspended a regular session in order to congregate in the so-called Gold Room of the Commercial Club in order to do honor to a notorious exponent of the black art who was warmly welcomed and feasted, for was he not going to foster a boom in Alta stocks? Try to imagine the brokers of the New York Stock Exchange doing that. In fact nearly all of these stock exchanges of the interior are cheap, contemptible. We are disposed to have most respect for the San Francisco exchange merely for the reason that there is no pretense that the dealing in Comstock shares is anything but gambling. A considerable portion of the population of San Francisco wants to gamble and the authorities are willing to permit them to do so under the guise of doing business, although they will not permit ordinary gambling. Moreover, the San Francisco brokers, satisfied with their regular clientele, make no attempt to inveigle unwary widows living in Vermont.

Reports from the West are to the effect that "mining brokers everywhere who have the best interests of the mining industry at heart are taking an active part in the proposed organization of a National Mining Brokers Association." When the prospectus gets to us we shall like to ask *when* did the "mining brokers" anywhere *ever* have the "best interests of the mining industry at heart"?

Democracy and Inefficiency

"The pioneer democrat had the backwoods and the Indian to fight. He won. He thought very well of himself in consequence. So his brains went raw. Raw, ready brains sufficed for his needs and emergencies. With an ax, a gun, a vote and some patent medicine, he survived. This greatly reinforced his initial generalization that 'one man was as good as another.' Very despotic was this son of liberty in his backwoods. His notion of liberty was that everybody was *free to agree with him.*

"Before we came into the world, the times were filled with phrases. Our birthday was celebrated by a phrase: All men are created equal. Into the Declaration of Independence Jefferson, a slaveholder, wrote this and all the signers signed it; and thus phrases and falsehood were made bone of our bone and flesh of our flesh. They essayed to reconcile equality and slavery by explaining that negroes were not exactly men.

"But you cannot continue to swallow a contradiction like slavery and equality for very long, without important results to your mental integrity. You never can substitute rhetoric for reality without important results to your brain. You cannot fight trained armies with rhetoric; and so the English burned Washington. The War of 1812, however, taught nothing to our phrase-mongers in Congress and elsewhere. We continued to be the 'land of the free,' and to boast about our 'glorious institutions and destiny.' We spoke of Europe's 'effete despotism'; we said, 'Uncle Sam had a farm for everybody'; and our public oracles from Jefferson to Bryan continued to build commonwealths with hot air.

"Thus cherishing the equality and slavery lie, and thus nourishing our Optimistic Fallacy with phrases which our easy success in the backwoods seemed to validate, we acquired our instinct to look away from any reality that fell short of squaring with the Optimistic Fallacy, any truth that refused to combine agreeably with it. From all such unpleasant facts, political and social, all facts that grated on the Optimistic Fallacy, we turned our eyes so quickly and so hard, that our national sincerity ended by acquiring a perpetual squint. Slavery was abolished—we know at what cost—but the four years' struggle of true national conscience, while it exalted a generation forever, could not undo the work of the 60 or 70 preceding years; the squint went on, it had become chronic. In great things, as in small, we hid behind phrases; changing the *words* satisfied us just as well as if we had thereby changed the *facts*. For instance, 'first' and 'second' class couldn't be painted on railroad cars; all passengers, being Americans, were equal; it would be 'un-American'; but paint 'Pullman' on a car, and everybody was satisfied.

"Under a great shock we see straight. If clumsily, still we are struggling for social justice. Our business honesty has improved. Perhaps we shall be cured of our squint without a surgical operation. Perhaps Uncle Sam may escape the fall he seems to be riding for; but if this is to be the case, we must see straight and keep ourselves right-minded on small as well as great occasions."

The foregoing paragraphs are composed from sentences selected and strung together from an article by Owen Wister in the *Atlantic Monthly* for June, 1915. They seem to us to reflect sharply the failing from which the welfare of our country has suffered more than is commonly comprehended. To such ideas as are therein exposed are traceable our muddling in military affairs; for example, in the Spanish-American War; our incompetency and waste that are most glaringly displayed in our municipal government, our ridiculous inefficiency in running our post office, and the harassing of our railways and great industrial corporations. Only exceptionally have we collectively done any great work well—the building of the Panama Canal being the brightest example—and when that has happened it has been for the reason that we have turned it over to an expert and kept our hands off. Probably if the Post-Office Department were turned over to Colonel Goethals in a similar way he would soon renovate it and run it as a well-organized business.

In our private and corporate affairs we have suffered largely from the same kind of inefficiency, although we have had such wonderfully rich resources to deal with that the results of disgraceful blundering have been dwarfed by the big returns that often have come in spite of ourselves. In late years we have begun to emancipate ourselves—at least our leaders have. A new spirit has pervaded us. Yet it has aroused the opposition of a large part of the people who would have us stick to the wastefulness of the corner-store retailer who must be protected in the competition which meant the survival only of the fittest. The labor leaders have consistently opposed everything savoring of scientific management.

In mining we have had similar experiences. The backwoodsmen operated lead mines in Missouri and Wisconsin, pick in one hand, rifle in the other, made something out of them and acquired the theory that anybody could run a mine—a theory that obtained until very recently. In many districts the ores sticking out among the grass roots were so rich and so easily won that indeed anybody could run such a mine, whether most advantageously or not is another matter. But since we have had recourse to the deposits of low-grade ore, involving engineering as a necessity, there has been another story.

The shock produced by the outbreak of the Great War has opened the eyes of America to many of its inefficiencies, has brushed away many false ideas. The hunters of the money devil who wanted to have the stock exchanges and commodity exchanges closed for being gambling hells saw them closed and the business of the country halted thereby, and having gained their wish voiced no opposition when they reopened. The trust-baiters ceased from blatherskiting and rejoiced over the efficiency that the great corporations exhibited in holding up the shattered props of our industries and later in reaching out into the foreign markets. But most impressive of all has been the lessons that Germany has been teaching the world, not only in warfare but also in peaceful sciences and arts. We shiver at the thoughts of what would happen if America had to match her ingenuity and power against the German kind of efficiency and organization.

New Director of U. S. B. M.

The appointment of Vannoy H. Manning to the directorship of the Bureau of Mines comes as a great relief from the apprehensions of what might have been. No longer have we to dread the shadow of the walking-delegate or of any of the friends of Brother Wilson, who presides over the Labor Department.

The leadership of the United States Bureau of Mines demands administrative ability above anything else. Our ideal for the directorship is a mining engineer of attainment and professional recognition, and administrative ability. But, alas! that ideal, like most ideals, is extraordinarily difficult of realization.

Mr. Manning is not a mining engineer, but he possesses executive ability. During the long illness of Doctor Holmes, when he was acting director, he won golden words of praise, not only for his administration, but also for his fine loyalty to his incapacitated chief and the ingenuous effacement of himself. It is always a good sign when a man's assistants support his promotion and work for it. Mr. Manning was the choice of the U. S. B. M. staff.

The *Journal* joins not only in the congratulations to Mr. Manning, but also to the President for making so good an appointment and to the mining industry for having a good man put at the head of the bureau that is so directly concerned with the welfare of all miners.

Inspiration Notes

The Inspiration engineers are working out some highly interesting problems, both in mining and metallurgy. The mill is now treating about 2700 tons of ore per day, and it is expected that it will be doing about 7000 tons by Nov. 1. After that everything depends upon getting the mine ready to deliver the enormous quantity of 14,000 tons of ore per day. That tonnage is indeed exceeded by far at Bingham, but that is a steam-shovel operation. Inspiration is going to hoist it through two shafts, 105 ft. apart. We may be in error, but we think that the achievement of this will be unprecedented. That it will be done there is no doubt. It is only a question of time.

In the Miami smeltery the Anaconda metallurgists, under the direction of Doctor Ricketts, have also cut loose from all precedents. Here is the first modern plant with no dust chambers. The Cottrell system is the substitute. The reverberatory furnaces—oil fired—are working upon an exceptionally rich charge—33% copper. They make more than 100 tons of copper per furnace per day, which is as much copper as there is slag. The slag runs 12 to 14% in alumina. In the flotation concentrates there appears to be an enrichment of alumina.

The Miami smelting plant was put in operation without a hitch. This is the modern American way of doing things, and especially is it the way of the Anaconda metallurgists. The report is becoming so common that it will soon cease to attract any attention. Nevertheless the feat, although often repeated, reflects great credit upon the engineers who perform it.

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It is said that spelter will be made from calamine at Donora, Penn., as early as Oct. 1. If that be done the engineers of the Steel Corporation will surpass all previous records in zinc-smelting construction. However, they have every incentive to be swift, and every facility is being given them. Construction work is being carried on by night as well as by day, and it is said that this job has precedence among all of those that the Steel Corporation has in hand.

BY THE WAY

In the opinion of a British officer, the best soldier is the miner. He is strong in the back, used to cramped positions, familiar with danger and explosions, and is said to put two and two together much quicker than men from other trades. This has been recognized by the Canadian military authorities, who have sent out a special appeal to all the mining camps for men for the proposed pioneer battalion.

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Alta and Emma Copper on the curb had their prices more than cut in half on Aug. 25. From 86c. the day before Alta was driven down to 30, closing at 42, and Emma from 88 vanished to 28, with a comeback to 43. This disaster, according to curb market gossip, was a heavy thrust at George Graham Rice. According to the New York *Sun*, Emma and Alta have been his two favorite mediums of speculation for some time. Since his return to the curb it has been common rumor that a group of sharpshooters as clever in their way as Rice once was in his have been gunning for him. The Aug. 25 drive was said to be their great coup. The stocks came back the following day with a modest degree of recuperative power, closing five or six points higher than on the day before, after bad breaks during the day. George Graham Rice at the close of the day smilingly reported that there was nothing in the stories that the gunners had hurt him, and to prove his triumph readily exhibited a fat bank roll with several bills of high denomination. The fall in the stocks, it was said, was a drive by the loan brokers. Other Curb Market experts attribute it to Rice himself, who is an old hand in such operations.

The late Jacob Langeloth, who at the time of his death, Aug. 14, 1914, was identified with many important mining enterprises, besides being chairman of the Board of Directors of the American Metal Co., left, as part of his $5,000,000 estate, the following securities, according to the appraisal of the state controller just published: 4300 shares in the American Metal Co., appraised at $1,204,000; 2000 shares of the F. W. Woolworth Co., preferred, $224,000; 2000 shares of the common stock of the same corporation, $168,000; 2350 shares of the Studebaker Corporation preferred, $190,350; 2520 shares of the common stock of the same company, $70,560; 600 shares of the Metallbank und Metallurgische Gesellschaft, $186,000; 11,400 shares of the Miami Copper Co., $171,000; 2430 shares of the Granby Consolidated Mining, Smelting and Power Co., $162,810; 4500 shares of the Nichols Copper Co., $135,000; and 750 shares of Sears, Roebuck & Co., common, $109,040, and 300 shares of the preferred stock of the same concern, $36,000. The bond holdings of the estate included: Philippine Island Government, $50,000; the Nichols Copper Co., $175,000; Mexican Petroleum Co., $55,500; and the State of New York, $26,750.

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August Mining Dividends

Dividends disbursed in August, 1915, by 23 United States mining companies making public reports amount to $3,637,387, as compared with $1,830,362 in August, 1914. Industrial and holding companies allied to mining paid $18,191,785 as compared with $11,617,745 a year ago, although it might be claimed that Amalgamated $3.77 distribution was a return of capital rather than a dividend. Canadian and Mexican companies paid $799,989, as compared with $563,506 a year ago.

United States Mining Companies	Situation	Per Share	Total
Alaska Treadwell, g	Alas.	0 75	150,000
Alaska United, g	Alas.	0.40	72,080
Bunker Hill & Sullivan, l.s.	Ida.	0 25	81,750
Bunker Hill Con , g	Calif.	0.02½	5,000
Caledonia, l.s.c	Ida.	0.03	78,150
Champion, c	Mich.	3.00	300,000
Chief, s.l.	Utah	0.05	43,838
Con. Interstate Callahan, z	Ida.	2.00	920,000
Eagle & Blue Bell, g.s.l.	Utah	0.10	89,315
Golden Cycle, g	Colo.	0.02	30,000
Hecla, l.s.	Ida.	0.07	70,000
Homestake, g	S. D.	0.65	163,254
Jim Butler, g.s.	Nev.	0.10	200,000
Mohawk, c	Mich.	2.00	200,000
Miami, c	Ariz.	0.75	560,069
May Day, g.s.l.	Utah	0.03	24,000
Prince Con, g	Utah	0.02½	25,000
Shattuck Arizona, c	Ariz.	0.50	175,000
Success, z	Ida.	0.08	120,000
United Verde, c	Ariz.	0.75	225,000
Wasp No. 2, g	S. D.	0.01	5,000
Wellington, g	Colo.	0.00½	50,000
Yellow Pine, l.z.s.	Nev.	0.05	50,000
Iron, Industrial and Holding Companies	**Situation**	**Per Share**	**Total**
Amalgamated, c	Mont.	1.00	2,308,318
Amalgamated, c	Mont.	3.77	8,702,359
Cambria, i	Penn.	0.62½	562,500
International Nickel, pfd	N. J.	1.50	133,689
St. Mary's Mineral Land	Mich.	1.00	160,000
U. S. Steel, pfd	U. S.	1.75	6,304,919
White Knob Cop. & Dev. Co.	Calif.	0.10	20,000
Canadian, Mexican and Central American Companies	**Situation**	**Per Share**	**Total**
Coniagas, s	Ont.	0.30	240,000
Dominion Steel	Can.	1.50	105,000
Granby, c	Ont.	1.50	222,721
Hollinger, g	Ont.	0.20	120,000
Lucky Tiger, g.s.	Mex.	0.09	64,380
Seneca-Superior, s	Ont.	0.10	47,888

The totals for the first eight months of the year are as follows: Mining companies, $40,691,163, as against $42,410,582 in 1914; metallurgical and holding companies, $54,825,758, as against $56,167,506 in 1914; Canadian and Mexican mines, $5,297,740, as against $12,064,368 in 1914. The accompanying table shows details of the month's payments.

Correspondence and Discussion

Transactions of the International Engineering Congress

The International Engineering Congress is a serious effort on the part of the five societies under whose auspices it is conducted to give to the profession and the world at large something of real professional value in the shape of a clear statement of present practice in all branches of engineering in the different countries of the world. The work of securing, editing and publishing the *Transactions* of the congress is enormous and is being performed purely as a labor of love. The officers and members of the committee of management representing the five societies guarantee the expense, and the price of the publications has been fixed just high enough to cover the actual cost of clerical work, printing and binding, on an assumption of membership which before the outbreak of the European war, was extremely conservative.

While the war and the resultant conditions, even in neutral countries, have greatly reduced the anticipated enrollment of members, they have not resulted in a proportionate reduction in either the quality or the quantity of the material offered for publication in the *Transactions*. Sufficient papers have already been received to assure the success of the congress and the value of the *Transactions;* but in order that the congress should be the greatest possible benefit to the profession, it is essential that it should enroll the greatest possible number of members.

W. A. CATTELL.

San Francisco, Calif., Aug. 19, 1915.

Fineness of Crushing for Assaying

To Mr. Nason's request for data on the differences in assay value produced by variation in the fineness to which the ore is crushed I give one example that may be of value when correlated with other examples.

Some years ago in assaying a large number of samples I found that the first "batch," run in duplicate, did not check. I give the results on one sample that is typical for the group. The ore was quartz, containing free gold about 1 oz. of silver and 5% to 10% of sulphides. On this ore the duty of a 1000-lb. stamp, taking 1½-in. feed and crushing to 20-mesh, was four tons. For assaying, the pulp was crushed to 100% through 100-mesh and 50% through 150-mesh. Results for the sample were: First run—original, $18.60; check, $22.10. Second run—original, $21.90; check, $19.20.

The ore was then crushed to 100% through 150-mesh and about 70% through 200-mesh and assayed with the following results: Original, $20.35; check, $20.40.

It is my opinion that the variation in results was owing to error in sampling a pulp that had not been crushed to a uniform size. While the fact that the last set of assays checks does not prove that the results are correct, if we consider that the average of the first four is very nearly the same value, and that a commercial assayer obtained substantially the same result, it seems reasonable to suppose that the true value was obtained.

Although I am not an expert assayer—my assaying for the last six years having been confined to the assaying of samples taken in the examination of mines, and my opinion is therefore to be weighed accordingly—it has been my experience that coarse crushing gives variable, but not necessarily low results. I have never found that fine crushing decreases the assay value. If the pulp sample is of reasonable size, I believe that the steel worn off the crusher will be relatively small in amount and therefore negligible.

G. A. JOSLIN.

Los Angeles, Calif., Aug. 20, 1915.

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

AMALGAMATOR. Elmer W. Hoffman, Tulsa, Okla. (U. S. No. 1,150,191; Aug. 17, 1915.)

BLAST FURNACE—Water-Cooled Valve. Luther L. Knox, Avalon, Penn., assignor to Knox Pressed & Welded Steel Co., Pittsburgh, Penn. (U. S. No. 1,151,193; Aug. 24, 1915.)

BLAST-FURNACE CONSTRUCTION. Luther L. Knox, Avalon, Penn., assignor to Knox Pressed & Welded Steel Co., Pittsburgh, Penn. (U. S. No. 1,151,192; Aug. 24, 1915.)

CAR—Cinder or Hot-Metal Car. Edgar A. Weimer, Lebanon, Penn. (U. S. No. 1,151,312; Aug. 24, 1915.)

CLASSIFIER. Albert E. Vandercook, Alameda, Calif., assignor to California Macvan Co., San Francisco, Calif. (U. S. No. 1,151,137; Aug. 24, 1915.)

CONCENTRATING TABLE. Robert Hunter, Spokane, Wash. (U. S. No. 1,151,466; Aug. 24, 1915.)

CRUSHER MANTLE. Ray C. Newhouse, Milwaukee, Wis., assignor to Allis-Chalmers Manufacturing Co., Milwaukee, Wis. (U. S. No. 1,151,119; Aug. 24, 1915.)

DRILLS—Valve for Percussive Tools. William Clement, Phillipsburg, N. J., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 13,959, reissue; Aug. 10, 1915.)

ELECTRIC DEPOSITION of Metals by Fusion. Arthur Percy Strohmenger, Westminster, London, England, assignor to Slaughter & Co., Ltd., London, Eng. (U. S. No. 13,970; Aug. 24, 1915.)

ELECTRIC FURNACE. James G. Marshall, Niagara Falls, N. Y., assignor to Union Carbide Co., New York, N. Y. (U. S. No. 1,149,203; Aug. 10, 1915.)

ELECTROLYTES—Process for Regenerating Electrolytes. Oliver Curtis Martin and Frederick Jaeger, Perth Amboy, N. J. (U. S. No. 1,140,522; Aug. 3, 1915.)

FELDSPAR—Treatment of Feldspar, Leucite, and the Like. Franz A. Rody and Harvey M. Burkey, Newark, N. J. (U. S. Nos. 1,151,498 and 1,151,533; Aug. 24, 1915.)

LEACHING—Device for Treating Ores. James Alexander Fleming, Globe, Ariz. (U. S. No. 1,150,669; Aug. 17, 1915.)

LEACHING—Recovery of Cuprous Sulphide from Ores and the Like. Raymond F. Bacon, Pittsburgh, Penn., assignor to Metals Research Co., New York, N. Y. (U. S. Nos. 1,151,234 and 1,151,235; Aug. 24, 1915.)

MINE-CAR COUPLING. William Towers, Christopher, Ill., assignor of forty-five one-hundredths to Roy Lockridge, Christopher, Ill. (U. S. No. 1,150,980; Aug. 24, 1915.)

MINING MACHINE. Edward O'Toole, Gary, W. Va. (U. S. No. 1,151,383; Aug. 24, 1915.)

MIXING APPARATUS. Ralph Baggaley, Pittsburgh, Penn. (U. S. No. 1,151,332; Aug. 24, 1915.)

ORE TREATMENT—Method of Treating Metalliferous Materials with Nitric Acid, and Recovering Solvents Used. Harry D. Rankin, Crafton, Penn., assignor, by mesne assignments, to Rankin Process Co., Phœnix, Ariz. (U. S. No. 1,150,787; Aug. 17, 1915.)

PHOSPHATE—Apparatus for Making Ammonium Phosphate. Frank S. Washburn, Nashville, Tenn. (U. S. No. 1,151,074; Aug. 24, 1915.)

ROASTING—Mechanical Ore-Roasting and Like Furnace. John Harris, Sheffield, England. (U. S. No. 1,149,754; Aug. 10, 1915.)

PERSONALS

George Watkin Evans, of Seattle, Wash., in in Alaska on professional business.

A. Charles Meagher, recently with H. Kenyon Burch at Miami, Ariz., has returned to San Francisco.

H. W. Hardinge, president of the Hardinge Conical Mill Co., is visiting the mining districts of northern Ontario.

Leo Von Rosenberg has returned to New York from Cripple Creek, Colo., where he made examinations of several properties.

K. Freitag is now at Lower Rochester, Nev., where he is constructing a 100-ton cyanide mill for the Nevada Packard Mines.

Hon. Edward Brown, of the Manitoba Government, has gone to make an examination of the Herb Lake gold field in northern Manitoba.

W. R. Parker and J. P. Watson, directors of the Mining Corporation of Canada, have been inspecting the company's properties in Cobalt.

P. G. Spilsbury, manager of the Aguacate Mines, is returning to San Mateo, Costa Rica, after a visit of several months in the United States.

E. S. Dickinson, formerly assistant professor of mining at the University of Kansas, has taken a position on the mining staff of the Canadian Copper Co. at Copper Cliff, Ont.

A. O. Baer, assistant superintendent of the blast furnace plant of the Illinois Steel Co. at South Chicago, has been appointed superintendent of blast furnaces for the Minnesota Steel Co., Duluth.

As a memorial to the late Dr. Joseph A. Holmes, Director of the Bureau of Mines, the Colorado School of Mines has established the Joseph A. Holmes Professorship of Safety and Efficiency Engineering.

L. D. Adams, of Oakland, Calif., and C. H. Maxey, of Rutherford, N. J., are two of the incorporators of the Zinc Company, Ltd., of Sherbrooke, Quebec, organized to establish zinc-smelting works and refinery.

H. G. Palsgrove, formerly manager of the Dolores mine and also of La Dura in Mexico, has accepted the position of general superintendent for the Aguacate Mines and will sail for Costa Rica early in September from New Orleans.

Charles E. Duncan has been appointed superintendent of the rolling mills and axle plant of the Cambria Steel Co., Johnstown, Penn., to succeed J. C. Fox, resigned. Mr. Duncan has been identified with the Lake Superior Consolidated Steel Co., Sault Ste. Marie.

Charles Camsell, of the Canadian Geological Survey, who was commissioned to make an investigation into alleged silver discoveries in the Lake Athabasca region, reports that nothing of economic value has been found there. Some nickel ore was found to occur, but not in commercial quantities.

E. A. Cappelen Smith is expected to arrive in New York about Sept. 10, returning from the successful starting of the leaching plant at Chuquicamata, for which he was the consulting metallurgist. While in Chile he also inspected the reduction works of the Braden Copper Co. at Sewell.

Horatio C. Ray will return to his duties as professor in the School of Mines of the University of Pittsburgh after spending his summer doing experimental flotation work with the Butte & Superior Copper Co. at Butte, Mont. On his way home Professor Ray will examine properties in Oregon and Colorado, besides visiting the Exposition at San Franciso.

OBITUARY

H. S. Bion, assistant superintendent of the Geological Survey of India, died at Calcutta on June 6.

Herbert Kynaston, director of the Geological Survey of the Union of South Africa, died at Pretoria, on June 28, aged 46 years.

Henry Richards, of Dover, N. J., for many years known as a mining engineer and manufacturer, died Mar. 26 last. He was a member of the American Institute of Mining Engineers.

Matthew Doyle, discoverer of the 85 Mine at Lordsburg, Grant County, N. M., a well-known Southwestern prospector, died in an El Paso, Tex., hospital Aug. 19. Mr. Doyle was born in Scotland 73 years ago and came to America at the age of 30 years, being employed in coal mines in Pennsylvania. He later moved to Colorado and thence to New Mexico, where he operated mines and prospected new territory. He had accumulated considerable property. The remains were interred in Evergreen Cemetery, El Paso.

Dr. Herbert Gray Torrey died at his home at Stirling, N. J., Aug. 29, aged 74 years. He was born in New York, being a son of Dr. John G. Torrey, for some time professor in Columbia College and the first head of the New York Assay Office. Herbert Torrey graduated from the College of the City of New York in 1860 and later from the College of Physicians and Surgeons. He entered the New York Assay Office and on his father's death succeeded him as chief assayer, holding that position for 39 years, until 1910, when he resigned. He had since acted as consulting metallurgical engineer. He was considered a high authority and during his service at the assay office was constantly consulted on metallurgical questions. He was a member of the American Institute of Mining Engineers and of the Society of the Cincinnati.

Max Hebgen, of Butte, Mont., vice-president and general manager of the Montana Power Co., died at the Presbyterian Hospital Aug. 24. Mr. Hebgen was recognized as a leading electrical engineer and had been prominently identified with several of the largest power projects in this country. He was born in Beaver Dam, Wis., in 1869; went to Butte in 1889, and up to the time of his death had been a resident of that city. In Butte he was associated with W. A. Clark as superintendent of the old Butte Electric Light Co. He was continuously in the employ of that company and associated concerns until the final organization of the Montana Power Co., of which he was vice-president, general manager and director. Mr. Hebgen was the active engineering and directing head of all development work of the Montana Power Co. and the concerns it succeeded. He had a large part in the organization of that company, one of the largest concerns of its kind in the world, which, upon completion of plants now under construction, will develop and market 225,000 hp. Mr. Hebgen's illness, which last June forced him to undergo treatment at the Chicago hospital, dated from an attack of pneumonia contracted more than a year ago on an inspection trip to the Thompson Falls power plant. From this illness he never completely recovered. He leaves a widow and a son 13 years old.

SOCIETIES

Lake Superior Mining Institute—About 300 members and guests of the institute will assemble at Ironwood on Labor Day, Sept. 6, for the 20th annual meeting. One day will be spent on the Gogebic range, where the second annual first-aid meet will take place in the forenoon. Edwin Higgins, engineer in the Luke Superior district for the Bureau of Mines, will be in charge. Dr. A. F. Knoefel, president of the American Mine Safety Association, will be the chief judge, assisted by six physicians from outside the district. Teams have been entered by the following companies from the different ranges: Oliver Iron Mining Co., Mesabi; Montreal Mining Co., Gogebic; Odanah Mining Co., Gogebic; Verona Iron Co., Menominee; Oliver Iron Mining Co., Gogebic; Judson Mining Co., Menominee; Castile Mining Co., Gogebic; Colby Mining Co., Gogebic; Republic Iron & Steel Co., Mesabi; Newport Mining Co., Gogebic; Pickands, Mather & Co., Mesabi; Republic Iron & Steel Co., Marquette; Cleveland-Cliffs Iron Co., two teams, Marquette. In the afternoon automobiles will transport the party to the Newport, Woodbury, Palms-Anvil, Wakefield, Norrie and Colby mines. In the evening a business session will be held.

INDUSTRIAL NEWS

Business growth has caused the Western Electric Co. to give up its old quarters at Portland, Oregon. Since 1910 the Company has been located on Fifth Street, but has now moved into a new two-story brick and concrete building which has been made ready for it at East Ash and Union Streets.

The General Naval Stores Co., 175 Front St., New York City, has taken up the sale of flotation oils as a special branch of its business. Recently the company has introduced a number of new oils for this purpose, including coal-tar oils, wood creosotes, etc. It is the intention to provide suitable oils for various ores, and a laboratory is maintained for this purpose, in which to test and match oils.

Editorial Correspondence

SAN FRANCISCO—Aug. 25

Total Production of California Petroleum in July was 7,738,643 bbl., an increase over the June production of 294,686 bbl. Shipments did not maintain the lead over production in July, which was the encouraging feature in the June operations. The July shipments amounted to 7,643,049 bbl., being 95,908 bbl. less than the production. Still this is not a discouraging figure. The total stocks at Aug. 1 were 59,650,219 bbl.

Committees for the National Mine Rescue and first-aid meet to be held at the Exposition, September 23 and 24, have been practically completed since making some necessary changes. Robert I. Kerr, secretary of the Metal Producers Association, is made chairman of the committee on recording and is also on the executive committee. Albert Burch resigned as chairman of the executive committee and George W. Metcalfe, manager of the Mammoth Copper Mining Co., has been elected in his place. Mr. Burch will remain on the committee. It is understood that D. C. Botting, commissioner of the Washington Coal Operators Association, has been appointed to the chairmanship of the committee to judge mine rescue work, R. Y. Williams having found it impossible to act. James Bagley, mine inspector of Washington, and Thomas Graham, chief mine inspector of British Columbia, have also been appointed to this committee. Dudley Michell, one of Mr. Graham's assistants, will probably be appointed to the committee on judging mine rescue. H. M. Wilson, formerly of the Bureau of Mines, continues to act as chairman of the board of managers.

Panama-Pacific Convention will be held in San Francisco Sept. 16 to 18 by the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Society of Civil Engineers, and the American Institute of Mining Engineers. The International Engineering Congress, which has been organized by these four societies and by the Society of Naval Architects and Marine Engineers, will be held from Sept. 20 to 25. A comprehensive program of technical sessions, inspection trips and other interesting features has been arranged for the benefit of those attending this general gathering of the engineering profession. A special train will leave New York on Sept. 9 arriving in San Francisco on Sept. 15, with stopovers at Niagara Falls, Colorado Springs and the Grand Cañon. A special train will also leave New Orleans on Sept. 12, arriving at San Francisco on Sept. 15. There will be no return special train service, but a choice of several routes is offered. Representative Canadian committees of the British Institution of Civil Engineers, the Canadian Society of Civil Engineers and the American Society of Civil Engineers have invited those attending the congress to return through Canada, inspecting en route the engineering works within convenient distance of the main line of transportation through the provinces of British Columbia and Alberta. The installations visited will include the water-power development of the British Columbia Electric Railway Co., the Western Canada Power Co., the Calgary Power Co. and a number of large irrigation projects in Alberta.

Dancing on the Deck of a Gold Dredge is the novel method employed by the Powder River Gold Dredging Co. to celebrate the completion of the hull of a new dredge being constructed at Sumpter, Ore. The dredge has 7½-cu.ft. buckets and is of the California type of elevator dredge. The framing of the hull was started on June 6 and the laying of the deck completed on June 30. The Yuba Construction Co., the builders of the dredge, invited the people of Sumpter, Baker and Columbia aboard the boat for a dance on the night of June 30. The deck was temporarily housed in all round with canvas 8 ft. high. The main truss posts, stay rods and similar parts were concealed with evergreens and 155 electric lights were arranged for lighting and ornamental effect. On shore a tent was erected off the stern of the boat, having a covered passage between the tent and the boat, and fitted up as a ladies' cloak room. Refreshments were served in the construction camp dining room. Aboard the boat, punch was served, and the Sumpter orchestra, providing the dancing music, was installed in the space between the main gantry posts; the posts being concealed by evergreens. The well hole was planked over so that the dancers could make complete and uninterrupted round of the deck. There were 125 couples in the grand march. The Yuba Construction Co. has always been noted for its fair treatment of employees in construction camps and in regions like this it has never been difficult to obtain sufficient labor where the character of labor necessary is usually scarce. The novelty of the dance aboard the dredge attracted the entire country. The entertainment was presided over by Paul E. Morse, construction superintendent, and his wife and daughter.

DENVER—Aug. 26

Contract to Furnish 5000 Tons of Steel Rails for the main line of the government railroad inland from Seward, Alaska, has been made by Colorado Fuel & Iron Co.

Elkton Consolidated Gold Mining Co. passed its quarterly dividend, due this month. With promised drainage benefits from the renewed pushing of the Roosevelt tunnel, the directors deemed it well to prepare for extensive exploration of the mine at new depths.

Suit Has Meen Brought by the El Paso Consolidated Gold Mining Co. against the Katinka Gold Mining Co. and the Progressive Mining & Leasing Co., both Cripple Creek concerns, for $10,000 alleged damages through wrongful removal of ore from the plaintiff's Ajax vein. Injunction is asked to restrain defendants from further trespass.

Colorado Gold Mining & Smelting Co., a corporation formerly operating mines and a smeltery in the Alma district, Park County, lost a foreclosure suit brought by the International Trust Co. of Denver. Judgment in the sum of $727,223 was declared for the plaintiff. Among the mines involved are the Atlantic and the Pacific.

President Zang, of the Vindicator, in sending out checks to cover dividends to stockholders for the last quarter, enclosed a circular letter concerning the company's financial affairs and the physical condition of the properties. Describing the Golden Cycle mine, he says: "The main orebody opened on the 18th level within two weeks shows an excellent grade of ore. Drifting is in progress with good values showing. In reaching this ore, a new orebody was encountered in a vein hitherto barren and it has been developed for over 180 ft. carrying average values of from $30 to $40 per ton. Two new orebodies have been opened on the 17th level. Sinking the shaft an additional 250 ft. from the 1900 level has begun." Of the Vindicator mine, he says: "Development on the 18 level has opened a large volume of ore in four different veins. Development during the coming quarter will undoubtedly add a considerable amount to the reserves."

Tungsten Ore has been reaching record prices in the Boulder County district. For a long time the standard price was $6 per unit for 60% WO_3 ore or concentrate. At times, during the past year, better prices have been announced and inducements offered miners to produce lower grades. Recently, demands for metallic tungsten in Eastern markets have exceeded the miners' ability to supply the raw materials. This was but natural in view of long refusals of dominating purchasing companies to buy any but rich materials. Now, purchasers have become liberal and have announced their eagerness to take any grade of tungsten ore from 3% upward, together with their readiness to pay $15 per unit irrespective of grade. Concentration of the ores is very simple. With the implied confessions on the part of purchasers, miners have given special study to the market and have concluded that, even yet, they are not "getting a square deal." With tungsten metal selling at $2 per lb., they feel that they should receive more than 75c. and, owing to the limited production, they are in position to insist on still better terms. Prediction is made that the price may jump to $20 per unit—$1 per lb.—any day.

BUTTE—Aug. 26

Butte Mines and Mills Now Employ 14,000 Men, according to reports recently received by State Mine Inspector W. B. Orem from 46 operating mines in and around Butte—10,597 under ground; 2820 on the surface; and 402 in mills. The Anaconda company has the greatest number of employees, 9865. It is working 30 mines, and the number employed averages more than 300 men to each mine. The Anaconda mine proper has the largest number of men employed, 750 under ground and 59 on the surface, a total of 809. Companies

other than the Anaconda, and the number of men employed, are as follows: North Butte, 848 men; Rainbow Development, 18 men; Butte & London, 14 men; Davis-Daly, 105 men; Butte & Superior, 1360 men; Butte-Alex Scott, 122 men; East Butte, 665 men; Butte-Ballaklava, 98 men; Atlantic Mines, 50 men; Pilot-Butte, 77 men; Tuolumne, 10 men; Elm Orlu, 260 men; Timber Butte mill, 134 men; Butte-Great Falls, 15 men; Bullwhacker, 25 men; Butte-Duluth, 3 men.

SALT LAKE CITY—Aug. 26

The United States Smelting Co. is increasing its roasting capacity at Midvale, by the addition of two Dwight & Lloyd roasters. This will make six, with the four at present in use. The installation will be completed in 10 days. There are 750 men on the payroll.

Investigations of Geologic and Topographic Conditions, and of water resources are to be undertaken in Utah by the U. S. Geological Survey at the request of Reed Smoot, senator from this state. The work contemplated includes general geological studies with reference to the ore deposits in the Oquirrh Range; a reconnaisance of the phosphate deposits of the Uinta Mountains; general investigation of the geology and ore deposits of the state; the completion of the Wellington-Sunnyside folio. Water investigations will be continued in coöperation with the state, and will include measurement of stream flow at 131 gage stations.

The Utah Power & Light Co. started its new power plant at Oneida on the Bear River, 17 miles northeast of Preston, Idaho, Aug. 13. The plant includes a 10,000-kw. water-wheel-driven generator, furnishing current at 6600 volts, transformers to step the voltage up to 130,000 volts, etc. This is delivered into the main line which runs to the terminal transformer station near Salt Lake City. From here it is stepped down to 44,000 volts and distributed over nine lines radiating to Bingham, Garfield, Salt Lake and other valley points. The new plant started up without a hitch and is in successful operation. It is one of several units or plants which will be added from time to time as more power is required. The company's property in Idaho has been assessed at $3,000,000 this year as compared to $2,700,000 the year previous.

SEATTLE—Aug. 24

Late Reports From Broad Pass, nick-named the "Rand of Alaska," are very encouraging. The Guggenheims have taken a number of options which late developments would indicate they intend exercising. About 50 miners and prospectors are now in the country either working on locations or prospecting for new lodes. Two towns, Colorado City and Wellsville, have been established at the mouth of Colorado River and a combined roadhouse and store has been built at Indian Creek. The area on which oreshoots have been exposed is about 10 miles in length and 300 ft. in width.

Small Stamp Mills Being Installed in many parts of Alaska show the substantial way in which a large number of properties are being developed. These mines are being made to pay their own way through the extraction of their own ore and there is no doubt in the minds of those who are in closest touch with Alaskan affairs that the small stamp mills which are becoming more and more numerous are already having an important bearing on the development of the territory. The investments run from $15,000 to $20,000 while the plant is capable of expansion through the simple process of adding stamps as they may be needed. Much is expected of the quartz in Fairbanks though it is conceded that were another Treadwell located there at this time it could not be operated on account of the exorbitant freight charges. In the experience of mining operators it takes about 10 years for a placer camp to turn over to a quartz camp after the rich placers are worked out, and while the district will produce millions from placers yet the cream has been taken out of the camp. The coming of another stamp mill means considerable better results to those who are now operating the mines, but it is confidently expected that it will be at least several years before Fairbanks is a full-fledged quartz camp of any proportions.

JOPLIN—Aug. 28

A New Zinc Smeltery to treat Joplin lead and zinc ores is being built at Kusa, a new town five miles east of Henryette, Okla., by George E. Nicholson and associates. Three blocks are expected to be in operation about Sept. 15, and additional blocks will be completed as quickly as possible until 10 are in operation. The Missouri, Oklahoma & Gulf R.R. has made a very low rate on zinc ore from Joplin to Kusa. The smelting company is said to have secured a natural-gas supply which will fulfill all their needs for at least 20 years.

HOUGHTON, MICH.—Aug. 28

The Stock of Copper which was accumulating on the docks here, much to the worry of some local people, has been moved. Several vessels came along and when they left the copper stock had vanished.

ISHPEMING, MICH.—Aug. 31

The Lake Superior & Ishpeming R.R., which handles most of the ore on the Marquette range, is operating to capacity. The mines are calling for cars but are unable to get all they want. The road placed an order for 500 steel cars in the spring but they have not been delivered as yet. When they are put in service about 300 old wooden cars will be scrapped. Ore is going out at a rapid rate, but all that is now in stock will not be moved. However, the outlook for the coming winter is very bright.

DULUTH—Aug. 28

At the New Minnesota Steel Plant the blast-furnace department is now being stocked with limestone and coal preparatory to the initial operations several months hence. There are 50,000 tons of limestone and over 100,000 tons of coal now in stock and more arriving regularly. At present this material is unloaded at the Missabe ore docks, in Duluth, and transported to the steel plant by train. It is understood to be a part of the general scheme later to procure the deepening and straightening of the channel up the St. Louis River to the steel plant, which channel is now navigable only by small craft. Following this, raw material will be docked directly at the furnaces, obviating the intermediate handling expense. The City of Duluth plans a monster demonstration to mark the inauguration of operations at the plant. The details have not yet been worked out.

BRAINERD, MINN.—Aug. 28

Labor Conditions on the Minnesota Ranges are unusual. Two months ago $1 a day and board secured an abundance of labor in the Duluth market. Orders for men at $2.50 are now going unfilled, although this is partially due to the Dakota harvesting season. Difficulty is experienced in securing large crews, due to European situation. Austrians will not work with Slavs and Italians, and the labor market is picked so bare that it is impossible to secure large crews of any one nationality.

HIBBING, MICH.—Aug. 28

The State Attorney General Has Overruled request of Mayor V. L. Power, of Hibbing, that the mining companies in the village of Hibbing be enjoined from removing any ore from their properties until their delinquent taxes have been paid. Efforts of the municipal authorities to collect the $750,000 delinquent taxes from the mining companies have thus far proved unavailing, and the matter is now in the courts. The operating companies, claiming gross extravagance on the part of the village officials, have declined to pay their taxes until they shall have been reduced to figures commensurate with the needs of the community.

TORONTO—Aug. 28

The Canadian Mining & Exploration Co. has issued a circular to the shareholders showing the investments and cash on hand as of Aug. 19, 1915. The statement shows investments in bonds to the amount of $2,185,763; demand loans secured, $50,000, and cash on hand $249,824, or a total of $2,485,587. This amount at the present market value of the securities shows a decrease in assets of $14,412 as compared with the prices at which the securities were bought. The accrued interest is not, however, taken into consideration.

Much Excitement Has Been Caused in mining circles by an extraordinarily rich find of gold on the Leyson-Dobie claims in Munro Township, about 11 miles east of Matheson. These claims have been operated by the Dominion Reduction Co. for about two months and their output during that period is estimated at upwards of $500,000. The shaft is down about 90 ft. on a 2-ft. vein which is stated to yield ore so rich that it is impossible to drill it and it has to be cut with chisels. Two specimens weighing together over 200 lb. and running from 2000 to 3000 oz. to the ton have been shipped to Toronto to be shown at the Canadian National Exhibition now in progress. It is stated that about a ton of this ore is now sacked and under guard at the mine. The present owners maintained strict secrecy as to the value of the mine until they had bought up a number of other claims in the district. Since the news became public there has been a great rush of prospectors into the neighborhood. Thomas W. Gibson, Deputy Minister of Mines, states that there is no doubt that a very rich and important strike has been made.

The Mining News

ALASKA

CLIFF GOLD (Valdez)—A new lead, richer and bigger than any before found on these claims has just been uncovered above old workings and traced for several hundred feet. It is 22 in. wide and carries free gold.

HOBEN-DAVIS, SULLIVAN-CASSIDY HOLDINGS (Hope) on Bear Creek have been purchased by Chas. E. Herron, who will install hydraulic plant to work the ground. Herron dredge on Six-Mile Creek near Sunrise is proving very successful and good season is predicted.

KENNECOTT (Cordova)—Bonanza and Jumbo have been shipping $2,000,000 worth copper a month since last June. It is announced that same production will be made during winter and in order to handle this Copper River & N. W. Ry. has placed orders for considerable more equipment.

GRANITE (Valdez)—With new machinery in full operation company took out $25,000 during July and this will be greatly increased during August and September as much low-grade ore was run through mill past month. Work of developing mine continues and much underground work has been done, blocking out enough ore to run mill for three years.

LANDLOCK BAY (Landlock)—W. A. Dickey, president of company, reports that about $30,000 worth of copper ore has been shipped from property this season so far and development work is being pushed as rapidly as possible. Company has also taken out considerable ore on Mason and Gleason claims near by but will not ship until after snow flies.

ARIZONA

Cochise County

PRIMOS CHEMICAL (Russelville)—Installing plant consisting of rolls, concentrator, jigs, etc., for treating ore from Stein and Boericke claims. Owen T. Smith is manager.

CALIFORNIA

Amador County

KENNEDY (Jackson)—Iron pipe line which for number of years has delivered water from reservoir to north shaft is to be displaced by wooden pipe line. This will be of modern construction, built of 2-in. staves held with iron bands. Change from iron to wood probably due to present high cost of iron.

McFADDEN (Jackson)—John McFadden reported to have made important strike near Aqueduct, of good quartz measuring 12 in. wide at depth of 30 ft. Property produced in early days; ore being worked in arastres. McFadden has installed gasoline engine for prospecting.

Butte County

ORO FINO (Magalia)—Big bed of gravel carrying high gold reported. Property owned by Robbers Roost Mining Co.

EUREKA (Magalia)—High-grade ore reported being shipped by Richards, MacDowell & Whitlock. Property situated on Magalia Ridge near Mineral Slide.

NATOMAS (Oroville)—Practical tests to determine mineral carried in tailings in Oroville field in Feather River district will be made at Thermalito. Where contents will warrant, redredging will be considered. Method will be first undertaken at Folsom by new No. 4 boat that is being rebuilt after design which will make possible replacing of ground with soil on top so that land will be reclaimed for agriculture.

Eldorado County

LYMAN A. BENDER AND CHARLES S. WRIGHT have taken purchase options on 160 acres of gravel claims between Hanks Exchange and Pleasant Valley. Development will start immediately. Property lies south of old Fort Jim gravel mines.

GEORGIA SLIDE (Georgetown)—Reconstruction of 10-stamp mill in progress. Large dump of ore will be worked.

RYAN (Shingle Springs)—Greenwater & Death Valley Copper Co., formerly operating in Inyo County and having also interests at Dale, San Bernardino County, has taken over this gold mine. Development is in progress with John McGee, formerly of Dale, as superintendent.

G. W. HOLLIWAY, of Granite, is preparing for development of an antimony claim in Greenhorn district. Miles H. Martin is also developing an antimony claim on Greenhorn Mountain and reports high-grade ore.

OLD MILL (Caliente)—M. Elliott, Fred Ramey and Joseph and Sebastian Asparren own property. Ore is being sorted and packed out to county road. Reported that purchase option has been taken by Eastern men. It is stated that some of so called low-grade ore will run 55% antimony.

Shasta County

BALAKLALA (Coram)—Mining operations will be resumed at once. Ten-year contract with Mammoth Copper Mining Co. to smelt ore signed recently. Production to start will be 250 to 300 tons daily, and may be increased later.

GREEN HORN (Tower House)—New oreshoot struck recently in crosscut tunnel at 133 ft. from portal. Drifting under way. Connection with No. 3 level, where shipping-grade ore is opened, will be made. Development work being pushed; crew of 25 men employed. Seven cars ore shipped to Mammoth smelting plant recently with satisfactory results. In addition to shipping-grade ore, 900 tons milling-grade ore stored in bins; milling tests will be made to determine best method of treatment. Property nine miles west of Tower House.

Trinity County

GEM MINE (Eureka)—This placer mine, together with old Schauber property, total of 400 acres, has been sold for consideration stated to be $40,000. Mine is situated on Trinity River, opposite south fork. Considerable gold production made here in past, hydraulic work being done each winter; water supplied through four-mile flume. Some platinum found here in addition to gold.

Tuolumne County

TARANTULA (Jamestown)—Henry T. Gage, former governor of California, has consummated deal for purchase of this property from United Gold Mining & Milling Co. of Paris. Mine is situated near Eagle-Shawmut. Gage also owns Jones mine adjoining Tarantula and will work two in conjunction.

APP (Jamestown)—Interest is attached to visit of W. J. Loring of Bewick, Moreing & Co. He was accompanied by Albert Burch and J. H. Bell of the Plymouth Consolidated. Their visit included Dutch-Sweaney. Reopening of the App mine through Dutch-Sweaney would be more economical than independently from surface. This fact lends color to the conjecture that there is probability of two properties being taken over by Bewick, Moreing & Co. Dutch-Sweaney was recently taken over by interests operating Melones mine in Calaveras County.

COLORADO

Boulder County

MINES AT RICO shipped 72 carloads of ore during July. Rico-Wellington Mining Co. led with 55 cars of copper, lead and iron ores; the Rico Consolidated Mining Co. shipped 15 cars of copper ore to Garfield, Utah. District is busier than for several years past.

Hinsdale County

GOLDEN FLEECE (Lake City)—Foundations are being laid for mill below dump of No. 3 adit. Treatment will be concentration, slimes over canvas tables and cyanidation of tails.

Lake County

ZINC-CARBONATE OREBODIES have been discovered in the Mosquito Range near Weston Pass, about 12 miles, in an air line, southeast of Leadville.

GARBUTT (Leadville)—John Cortellini is replacing his original lot of mining machinery with heavier installation adequate to handle mine's new requirements. Steam, piped from Ibex boilers, will drive double-drum, first-motion hoist and new 15-drill compressor. He contemplates erecting 200-ton mill to handle low-grade gold ore, a million tons of which he estimates as developed.

YAK (Leadville)—Persistent rumor is to effect that this company has purchased Aladdin Group, of 122 acres, intersected at about six miles in tunnel. Deal is by bond for $600,000 running four years. If option to purchase be not exercised within that period, lease will continue additional 6 years. Development of this ground, well to east of main portion of this district, will be watched with interest.

Ouray County

MOUNTAIN KING (Red Mt.)—Vein of lead-silver-copper ore, 17 ft. thick, has been opened by leasers.

REVENUE (Ouray)—St. John Mining Co., Ltd., of London, Eng., has acquired this large tunnel project and will push further work as soon as war conditions will permit.

CAMP BIRD (Ouray)—During second quarter of 1915 mill stamped 7626 tons. Bullion and concentrate sales amounted to $187,992. Costs of mining, development, milling, shipment, smelting, and marketing products totaled $78,720. This figure does not cover expenses of maintaining foreign offices.

San Juan County

IOWA-TIGER (Silverton)—Flotation machinery is being installed.

HAMLET (Howardsville)—After idleness of seven years, mill was put into service Aug. 15. Machinery has been considerably altered while mine has been developed and put into shape to keep mill supplied.

Teller County

BLUE FLAG (Cripple Creek)—At annual meeting held recently it was decided to sink main shaft 300 ft. below its present depth of 1100 ft.

AJAX (Victor)—Mill being repaired and altered in preparation for resumption. Mackay lease has opened shoot of high-grade ore.

INDEPENDENCE (Victor)—Gault lease, 400 level, has opened shoot of $20 ore. Thomas B. Crowe, metallurgist of Portland company, is remodeling mill and fitting it to handle ores from both these large groups of property. He does not expect to have mill ready for service before beginning of 1916. When it is in operation, no ores will require up-hill transportation from mines or dumps as is the case with the present Portland mill.

IDAHO

Shoshone County

CALEDONIA (Kellogg)—It is planned to maintain 3c. dividends rest of year. Raise is being driven from lower level to cut downward extension of ore-shoot. This will give additional depth of 500 ft. and is expected to double ore-reserve.

SUCCESS (Wallace)—New orebodies recently found are expected to lead to large increase of reserves. Crosscut on 1200-ft. level has penetrated 6 ft. of clean shipping ore that is estimated to average about 70% lead. Same oreshoot on 1100 was three times as wide but much lower grade. New shoot on 860 level shows 7 ft. of shipping ore.

INTERSTATE-CALLAHAN (Wallace)—At an annual meeting of stockholders at Duluth, Aug. 16, two sets of officers were elected. Roberts-Sussman interests, which have been in control during past year, elected J. A. Percival, former secretary, to presidency, while Callahan-Boutin contingent elected P. H. Nelson president. Attorneys for eastern investors secured temporary restraining order from courts enjoining James Callahan from voting 170,000 shares held by Callahan Mining Co. on ground that this was an Idaho corporation and therefore not entitled to vote at meeting held in Minnesota. With this block of stock disposed of they elected their own officers, who proceeded with transaction of other business, including declaration of quarterly dividend of 50c. a share. Compromise between two factions is unlikely and fight will undoubtedly be carried to courts.

MICHIGAN

Iron

EUREKA (Ramsey)—New 2000-ft. electrically driven compressor has been purchased for this property.

JONES & LAUGHLIN (Wakefield)—This company has started drilling on eastern extension of Gogebic range. Several drills will be worked all winter.

WICKWIRE (Iron River)—About 150,000 tons will be shipped from Homer mine this season. All of stockpile and everything that is being hoisted will be shipped.

BRISTOL (Crystal Falls)—Contract has been let for electrically driven compressor. Current will be purchased from Peninsular Power Co., which is to extend its line to Crystal Falls.

BALKAN (Alpha)—Draglines which have been stripping here are now getting out some ore. This is being pulled from pit in dump cars and taken to surface and loaded into railway cars. Draglines are working better than expected in this ore. Shaft is now concreted from top to bottom; work was finished this week. This mine will be big shipper next season.

CLEVELAND-CLIFFS IRON (North Lake)—Work of stripping overburden from orebody found on Sec. 6 was started by contractors this week. Temporary track from main line of railway was laid in fast time. Only 75,000 cu.yd. are to be moved and this will not take long. No ore will be shipped from there this year. Ore will be mined by milling method. There is only about 30 ft. of sand over ore and it would not be possible to take it out from Morris-Lloyd workings. There are over 200,000 tons in this deposit.

MINNESOTA

Cuyuna Range

BRAINERD-CUYUNA (Brainerd)—Company prepared to ship at least one cargo before close of season, although product has not as yet been sold. Pumps handling about 1600 gals.

IRON MOUNTAIN (Manganese)—Mine working to capacity, and all production being shipped. Third drift now being opened. Town of Manganese, dependent solely on this operation, is now crowded, all houses rented and many being built.

Mesabi Range

FAYAL (Eveleth)—One shovel loading from stockpile. Shovel in pit loads ore part time and is used part time loading paint rock.

SCHLEY (Gilbert)—Schley and Elba mines in need of more miners. Operations being extended every week. Large shipments of ore to be made before navigation closes.

LEONARD-BURT (Chisholm)—This pit mine has resumed operations. One hundred men given work the first day. One shovel working two shifts. The property was idle four years.

OLIVER IRON (Coleraine)—Mesabi road broke record for hauling ore from Oliver mines here this week. With only one shift working, 891 cars were sent out in one day. Thirteen trains left mines.

MISSABE MOUNTAIN (Virginia)—One shovel at work in pit and another at stockpile. Mine was idle several years. Ore that is being moved from the surface stood at mine for almost five years.

OLIVER IRON (Chisholm)—Company's new operation in Sec. 27, 58-20, which has not yet been given name, is progressing rapidly. Main hoisting shaft is down 230 ft. and timber shaft 125 ft. Large volume of water being encountered, but no more than was anticipated. Surface equipment, power plant, etc., well under way.

MACE (Nashwauk)—Butler Bros., stripping contractors, are trying out new type of Bucyrus steam shovel in removing overburden from Mace No. 2 property. Shovel has heretofore been used mainly for coal loading in Pennsylvania fields. Besides being of extra large size, machine has boom of sufficient length so that overburden may be removed from deposit without necessity of laying tracks into pit, unless depth be too great.

Vermillion

PIONEER (Ely)—Night shift of 200 men added to crew.

McCOMBER (Ely)—Two 150-hp. boilers and other surface equipment being installed. Railroad spur 1¼ miles long has been surveyed. Shaft somewhat over 100 ft. deep; drifting in progress. Ore thus far encountered is similar to usual Vermilion Range product.

MONTANA

Silver Bow County

EMMA MINE (Butte)—Under an agreement with Butte Copper & Zinc Co., owner of Emma mine, Anaconda is going ahead with development of property, at Colorado and Silver Streets in heart of Butte. Is now installing machinery preparatory to unwatering shaft and is building fence around property.

DAVIS-DALY (Butte)—Company has cut another vein in southwest crosscut on 2500 level of Colorado mine. Whether new vein is Hesperus vein, for which company has been driving, is not yet known. It is reported that crosscut had cut into vein about 11 ft., all in good commercial ore. Entire width of vein has not yet been ascertained.

LEXINGTON (Butte)—About 400 men are at work on this mine of Anaconda company, preparing same for reopening. Repairs and retimbering in shaft have reached below 600 ft. level close to water level, which is still about 1000 ft. deep in shaft. New engine house has been erected and old buildings on property have been repaired for use.

BUTTE & LONDON (Butte)—Reopened Aug. 5 with a force of 20 men. Present work is in hands of T. F. Cole and associates of Rainbow Development Co. which has a contract for development work outlined and will take stock in company for remuneration. Working force will be increased and it is expected that 45 men will be on payroll within short period.

BUTTE & SUPERIOR (Butte)—On Aug. 20 company filed in federal court its monthly statement of ore treated by oil-flotation process in month of July, in compliance with order of court made in November, 1913. According to statement, oil-flotation plant handled 41,547 tons of ore, recovering 9843 tons of concentrates. Cost of flotation per ton was $2.95; value of concentrates per ton was $75.76.

ANACONDA (Butte)—On fulfillment of management plans, will have a capacity for producing 300,000,000 lb. of copper a year. In addition sulphuric acid and spelter will be turned out in quantities not yet fully determined. A one-ton experimental plant has been completed for purpose of devising method for profitably treating zinc ores. Three sections of concentrator have been remodeled and remaining five will be altered in rotation to conform with those already changed. Nominal capacity of each unit will be 2000 tons per day. One will always be kept in reserve so that probable capacity of plant will be close to 15,000 tons from seven operating sections. New copper refinery at Great Falls will be completed, it is expected, by Jan. 1, 1916. It will have monthly capacity of from 10,000,000 to 15,000,000 lb. of copper, against 5,000,000 lb. from old plant. Existing Great Falls refinery will be scrapped.

NEVADA

Storey County

COMSTOCK PUMPING ASSOCIATION (Virginia City)—Cleaning out east crosscut from Ophir-Mexican winze on 2700 level and preparing to install electric hoist at Ophir shaft.

MEXICAN (Virginia City)—West crosscut on 2700 level from winze station passed through 15 ft. of quartz and vein matter of low assay. Six-foot east crosscut shows quartz formation with streaks sampling to $25 per ton.

JACKET-CROWN POINT-BELCHER (Gold Hill)—Mill received 979 tons dump rock and shipped bar of bullion to smeltery. Timbering and general repairs continued.

OPHIR (Virginia City)—Development begun at top and bottom of vein 7 ft. wide. Samples assay from $3.75 to $22.75 per ton. Central tunnel development continues; 440 cars of ore saved from stopes and drifts; 320 tons milled.

UNION CON. (Virginia City)—On 2500 level, 65 ft. south of old Sierra Nevada incline station, 6 cars taken out in sampling, averaged $23.85 per ton. North drift in quartz 7 to 12 ft. wide; last 14 cars extracted sampled $17.55 per ton.

NEW MEXICO

Grant County

OCTO (Lordsburg)—Company has completed erection of headframe at Lee's Peak mine and will proceed with shaft sinking on contract. Bids have not yet been opened.

MEEKER MINING CO. (Silver City)—Company has just been incorporated by Z. D. White, J. A. Peterson and Adam Esplane. Will operate mines and mill at Pinos Altos.

JOHNNY BULL (Steins)—Mine has been taken over under lease by John Moffitt of El Paso, Tex. In same camp James Coil has made rich discovery of high-grade copper-gold ore north of Steins.

85 MINE (Lordsburg)—Company has put two diamond drills to work exploring ground below 450-ft. level. Smith and Travers, of Ontario, in charge of drilling. Caterpillar tractors formerly on 85 Mine ore haul have moved to Safford, Ariz., and will haul from Graham Mountains.

HOP CAÑON (Kelly)—Company is doing development work and getting into paying ore. Operations in district are encouraging.

Socorro County

ROSEDALE MINING & MILLING CO. (Rosedale)—Property will be sold, to satisfy judgment for $75,613, at Socorro County court house on Sept. 7.

Taos County

BUFFALO-NEW MEXICO (Red River)—Two shifts employed in sinking Silver King shaft at rate of 4 ft. per day. Shaft is now down 170 ft. and will be sunk to 300-ft. point before Nov. 1. Twenty feet of milling ore exposed in crosscut at 100 ft. level, 9 ft. averaging $15 per ton gold and silver, and 5 ft. averaging $19.90.

MEMPHIS-RED RIVER (Red River)—Upper tunnel on Memphis claim has been driven distance of 90 ft. on 2 ft. of ore averaging $30. Breast of intermediate tunnel has reached a point 200 ft. from portal. Vein averages 2.5 ft.; assays approximate those in tunnel No. 1. The two tunnels recently connected by 120-ft. raise.

PENNSYLVANIA

Lebanon County

LACKAWANNA STEEL (Lebanon)—Will erect benzol plant at Lebanon where it has two blast furnaces and byproduct coke plant. Estimated output of plant is 1600 gal. a day. It is reported that contract has been closed for sale of its 1916 output.

Potter County

NEW JERSEY ZINC (Millport)—Construction of extensive addition to zinc-oxide plant is now under way, and it is contemplated to complete it by end of November.

UTAH

Beaver County

LEONORA (Milford)—Recently ore was opened on 400 level on east-west fissure, and drifting is being done for intersection with north-south fissure. Machine drills are being used. These are part of the new equipment recently installed, including a three-drill compressor and hoist, both electrically driven.

Juab County

TINTIC MILLING (Silver City)—Excavating for mill has been completed, and concrete work is receiving attention.

SCOTIA (Tintic Junction)—Cave 180 ft. long, showing some mineralization, has been opened at this property, which is being worked under bond and lease by Chief Consolidated.

GEMINI (Eureka)—Pumping plant is keeping 1650 and lower levels of this property and the Ridge & Valley unwatered. Good tonnage was shipped by company and by leasers in July.

MAMMOTH (Mammoth)—Copper ore carrying gold and silver is being shipped. Five cars of low grade from mill dump southeast of Silver City were shipped week ended Aug. 13.

BULLION BECK (Eureka)—Zinc ore is being mined in four places by lessees, who are making shipments. Anderson-Goodwin lease is jigging 10 tons of ore daily from dumps and making a lead-silver concentrate.

UNCLE SAM (Eureka)—Work has been started to try and find extension of new orebody or ore zone just opened in Yankee property adjoining. Uncle Sam and Yankee each own part of original Humbug claim in which strike was made. Two ore shoots have previously been opened in this ground.

EAGLE & BLUE BELL (Eureka)—Ore has been opened from winze sunk 82 ft. below 1700 or deepest level. Drift 60 ft. south of winze cut full face shipping ore. It is proposed to drift from 1700 level to newly acquired Victoria property, which can be reached in 900 ft., and 600 feet. deeper than present Victoria workings.

YANKEE (Eureka)—Sinking is being done on new strike and 5 ft. of silver-lead ore has been opened. Raising for ore bed from tunnel 175 ft. lower will be done. Strike is in western part of Humbug claim and is apparently an entirely new orebody. Twenty-four leasers are mining zinc ore and are making shipments.

MAY DAY (Eureka)—Seven cars of high-grade silver-lead ore have been mined since recent dividend of 3c. a share, or $24,000, was declared. Some of this ore runs $70 to $80 a ton and gross value of seven cars is approximately equal to the dividend. Developments in western part of property have been particularly encouraging.

Salt Lake County

MICHIGAN-UTAH (Alta)—Tramway is now working and taking ore from City Rocks lease down to Tanner's Flat.

WASATCH MINES (Alta)—Projected drainage tunnel to be driven 160 ft. deeper than old Columbus Consolidated workings, is to be started soon. Length will be 5000 ft., of which 3000 ft. will be in mineralized ground.

PRICE (Salt Lake)—Work of driving main tunnel is progressing. Drills will probably be installed when power line to Cardiff is completed. Objective point of tunnel is ore-bearing fissure, which was opened on surface by trenching.

Summit County

JOHN THE REVELATOR (Park City)—Fissure has been cut on 150 level of incline. Five feet of oxidized vein material showing iron is being followed on main level. Small shipments running well in silver and lead have recently been made.

NEW QUINCY (Park City)—This company, formerly Thompson-Quincy Consolidated Mining Co. has been reorganized to provide means for carrying forward development. An assessment of 1c. a share has been levied, delinquent Sept. 2. Development has been resumed. The property lies between the Daly West and Daly-Judge. W. Mont Ferry is president.

WILLIAMS DEVELOPMENT CO. (Salt Lake)—F. T. Williams, president of this company, which for several years has leased upper levels of Daly West in Park City, has taken 3-year lease and bond on old Miller property in American Fork Cañon. Ike Wadley has property under lease at present, and sub-lease has been given by him to Williams company, which has been working about 10 men for the past two months. New lease and bond begins Nov. 1.

Utah County

MINERAL FLAT (American Fork)—Leasers are working at this property, and have ore ready for shipment.

MILLER HILL (American Fork)—Wadley lease has several teams hauling ore. Lead-carbonates have been opened in three places on Wyoming claim.

DUTCHMAN (American Fork)—Tunnel is being driven by Wild brothers to cut vein at greater depth. This reached ore at 200 ft. Shipments will be resumed.

WISCONSIN

Zinc-Lead District

AN INCREASED OUTPUT OF HIGH-GRADE ZINC ORE will result from many additions being made in roasting capacity. There are now in operation the National and Campbell plants, at Cuba City, the Empire and Homestead, at Platteville, the Linden Zinc, at Linden, and that of the Mineral Point Zinc Co., at Mineral Point. The old Enterprise roaster, at Platteville, has been overhauled by Kistler & Stephens and will be in operation soon; Utt & Thorne Co. will start up the Benton roaster, at Benton, recently purchased by it; the Wisconsin Zinc Co. is repairing the Joplin plant, at Galena, and is rushing to completion the new $100,000 roasting equipment at New Diggings.

LONGHENRY (Benton)—Longhenry Brothers are erecting small milling plant on Spensley land adjacent to the Fox mine.

POLLARD & SAXE (Linden)—High-grade sheets of jack have been penetrated by shaft on Gillam land just ahead of the Ross mine at Linden.

VINEGAR HILL ZINC (Platteville)—This company has proved up and verified drill-hole results obtained on this tract adjoining Champion mine, at New Diggings, and has begun shaft sinking.

KING SOLOMON (Platteville)—Local company has opened up good body of high-grade zinc ore in shaft and crosscut in this abandoned property seven miles south west of Platteville.

CRUSON (Platteville)—Stephens & Kistler will start at once to sink shaft and construct milling plant two miles south of Platteville. Rich cuttings were found in number of drill holes ahead of old mine workings which were abandoned four years ago.

CANADA

Manitoba

GOLD PAN (Gold Lake)—This property recently taken over by Boston and St. Paul capitalists is showing rich ore in new workings. A 4-ft. vein, showing free gold, has been struck at depth of 15 ft.

Ontario

BELLELLEN (South Lorraine)—Will resume operations.

TECK-HUGHES (Kirkland Lake)—Buffalo after sampling this mine has declined to purchase.

IMPERIAL (Porcupine)—Has cut promising vein on the 100-ft. level. This property has just been re-opened.

JUPITER (Porcupine)—Meeting has been called for Sept. 8 to reach decision with regard to offers made for property.

MINING CORPORATION (Cobalt)—For four weeks ending July 20 milled 10,257 tons from which net profit was £10,171.

CONIAGAS (Cobalt)—Will install small cyanide plant to treat concentrates which assay about 100 oz. and were formerly sent to smeltery.

NIPISSING (Cobalt)—The hoist room at shaft No. 64 was struck by lightning and burned down on Aug. 25, causing loss of $2000, covered by insurance.

CROWN-RESERVE (Cobalt)—The directors have decided to discontinue dividends for time, owing to disappointing results from draining of Kerr Lake and low price of silver.

NORTH DOME (Porcupine)—Timiskaming of Cobalt, which has a controlling interest in this property, has commenced diamond-drilling; results of which will determine its future policy.

DOME LAKE (Porcupine)—Ore averaging from $18 to $20 per ton is now being taken from 400 level. Oreshoot is 3 ft. in width and has been developed for about 30 ft. in length, vein being still good in face.

COBALT LAKE (Cobalt)—An oreshoot developed at 380 level shows 26 in. of high grade. In one week's development 36 tons of ore, which it is estimated will yield net profits of $35,000, have been extracted.

CONIAGAS (Cobalt)—The erection of a small cyanide mill is in progress, which is expected to be in running order in two months. Slime tailing will be re-treated over canvas and precipitate obtained refined at Thorold smeltery.

CITY OF COBALT (Cobalt)—System of veins has been developed under center of town of Cobalt at 200 and 300 levels. Vein 5 in. wide of high-grade ore has been opened up and numerous small veins in wall rock of drifts are undergoing development with satisfactory results.

WEST DOME (Porcupine)—Shareholders on Aug. 20 ratified re-organization plan submitted by directorate which involves formation of a new company, "West Dome Consolidated Mines," capitalized at $3,000,000. Two-thirds of stock will be issued to old shareholders in proportion of two shares of new for every three of old stock.

MEXICO

Sonora

EL TIGRE (Ysabel)—Several tons of precipitates have been brought out and shipped to Selby, which is first shipment made for several months.

SANTA ROSA (Cabullona)—H. F. Brown who is operating property has encountered vein, about 12 in. wide, of oxide ore running about 30% copper.

MINA MEXICO (Tonichi)—This property has practically closed down and it will be some time before work is resumed. Has been unable to operate smeltery for lack of coke, as Southern Pacific which ran to mine, has about been abandoned on account of troubles south of Hermosillo.

The Market Report

Metal Markets

NEW YORK—Sept. 1

The markets for copper, lead and zinc were excited and rather chaotic during the last week, there being in each case a sharp rise at the beginning of the week which was followed by a decline, especially sharp in the case of copper.

Copper, Tin, Lead and Zinc

Copper—At the close of our last week of record, sales of copper at 16.85c., basis New York, had been made. On Thursday the market opened with sales at 16⅞c., and closed with sales at 17⅞c., or about 18c., regular terms. Thus, the market had come to the asking price of the principal producers, a large business being done on the way up. However, the market never became firmly established at 18c., regular terms, there being sales on Friday and Saturday all the way from 17½@18c., regular terms. Some of the principal producers even appeared to be willing to accept business at small concessions; moreover, none of them was averse to taking business for export at prices ranging from £87, c.i.f. London, to £84½, c.i.f. London, which at current rates of exchange figure out ½ to ¾c. below the New York price. By Monday the domestic demand for copper had about petered out and the smaller producers and agencies promptly cut prices and continued to do so on Tuesday and Wednesday, during which part of the week business was very light indeed.

What appears to have happened in the market is something like this: It has been recognized for a long time that there was potentially a large demand. At the latter part of the previous week this began to exhibit itself, and the buying for prompt delivery indicated that the stocks of manufacturers were low. A very large volume of business developed on Thursday, and sellers, misreading the signs, raised their prices too sharply. This frightened and disgusted many manufacturers who were interested in contracting for copper but were under no immediate pressure to do so, and went home saying they would await developments.

The business transacted during our last week of record is estimated at 30 to 40 million pounds, which was probably about equally divided between domestic and foreign orders. A highly encouraging feature of the domestic business was the buying of considerable quantities of copper by wire-drawers, who are not supposed to have any connection whatever with military contracts.

Copper Sheets are quoted about 23c. per lb. for hot rolled and 24c. for cold rolled, with usual extras. Wire prices are unsettled; quotations may be put at 18.50@19c. per lb. at mill.

Copper Exports from the United States in June are reported by the Department of Commerce as follows: Pigs, ingots and bars, 36,739,762 lb.; plates and sheets, 3,554,055; rods and wire, 8,559,324; scrap and old, 1,238,845; total, 50,091,986 lb. Exports for the fiscal year ended June 30 were 677,303,822 lb. In addition 5026 tons ore and matte were exported in June. Imports for June were 24,773,059 lb. metallic copper and 8,387,583 lb. in ore and matte; 33,160,642 lb. in all. The imports for the fiscal year ended June 30 were 152,443,247 lb. copper and 99,967,985 lb. in ore and matte; 252,411,232 lb. in all.

Tin—The tin market was dull and a little easier, chiefly on account of the drop in sterling exchange. The statistics for August are good. The tin committee of the New York Metal Exchange has issued a circular explaining how the British Consular guarantees should be complied with.

Lead—On Aug. 26 the A. S. & R. Co. raised its price to 4.70c., but before it did so, other producers had sold largely at 4.60c. and 4.65c., a big tonnage being placed especially with ammunition contractors. On Aug. 27 the A. S. & R. Co. raised its price to 4.90c., following sales by outsiders at 4.80c. On Saturday and Monday outsiders, not to be outdone again, became more reserved and succeeded in realizing 5c. on some moderate tonnages, especially for deliveries during the last quarter of the year. The demand then faded away, however, and at the close the lead market was showing a weaker tone. Reports from corroders and sheet and pipe manufacturers are not very good. The demand of last week was chiefly from the makers of ammunition.

Spelter—On Aug. 26-28 the principal consumer bought a large quantity of spelter at a sharp advance in price, especially as between Aug. 27 and 28. This buying, together with other orders, created confused and excited conditions similar to what prevailed when spelter was 10c. higher. Spelter was bought and sold in round lots for the same delivery in the same office at a difference of 1c. per lb. in price, within 10 minutes. The large demand having been filled, buyers became conspicuous by their absence, and sellers immediately exhibited once more their desire to get spelter off their hands, with the natural result that the price began to sag off again. Business last week was chiefly for delivery during the last quarter of the year. However, some considerable sales were made for delivery during the first quarter of 1916. This business was taken at a large discount from current quotations. A trifling amount of prompt business was done at fancy prices.

DAILY PRICES OF METALS IN NEW YORK

Aug. Sept.	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
			16¾		4.60	4.45	12.00
26	4.6475	46¾	@17¼	34½	@4.70	@4.65	@14.00
			17⅜		4.80	4.65	13.50
27	4.6325	47⅛	@17¾	34½	@4.90	@4.80	@15.50
			17.35		4.90	4.80	15.00
28	4.6325	46¾	@17.85	34½	@5.00	@4.85	@16.50
			17.30		4.90	4.80	14.50
30	4.6250	47	@17.50	33½	@5.00	@4.85	@15.50
			17.10				14.00
31	4.5850	46⅜	@17.20	33½	4.90	4.75	@15.00
			17.00		4.85	4.70	13.50
1	4.5100	46¼	@17.20	33¾	@4.90	@4.75	@14.50

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Aug.-Sept.	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
26	22 13/16	70⅞	72	82½	17.02	155	156¼	22⅜	4.62	66	13.62
27	23 1/16	71⅛	72⅜	84½	17.44	153	154	22 13/16	4.71	68	14.03
28	22 13/16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
30	23	68½	69⅜	84½	17.44	150½	151⅞	22⅜	4.69	70	14.45
31	23	68½	69⅜	84½	17.32	150⅜	152	22⅜	4.58	72	14.76
1	23 1/16	67⅞	69	84½	17.07	150⅜	153	22 1/16	4.51	72	14.55

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; B60 = 12.85c. Variations, £1 = 0.21⅜c.

The American business of Beer, Sondheimer & Co. has been incorporated under the laws of the State of New York as Beer, Sondheimer & Co., Inc., with B. Elkan, president, and O. Frohnknecht, as vice-president.

Brass special spelter was reported sold on Sept. 1 at 17.40c. per pound.

Zinc Sheets—Business has been on a considerable scale. The base price for carload lots is unchanged at $16 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

Other Metals

NEW YORK—Sept. 1

Aluminum—Supplies are still rather low and demand is steady. Quotations are 35@37c. per lb. for No. 1 ingots, New York.

Antimony—Sales are rather slow, though there are some large inquiries reported on the market. Ordinary brands are quoted 29@31c. per lb., while 45@48c. per lb. is named for Cookson's.

Nickel—Prices are steady and unchanged at 40@50c. per lb., according to size and terms of order. A premium of 3c. per lb. is charged for electrolytic.

Quicksilver—Trade has been fair. New York quotations are $89 per flask of 75 lb. for large lots; $90 per flask for smaller orders. San Francisco reports by telegraph $87.50@90 per flask, with market firm, but active; $95 was paid early in the week. London price remains £18 per flask, the same price being quoted by second hands.

Gold, Silver and Platinum

Gold—Another very large shipment of gold has been received at New York from London. Notwithstanding this sterling exchange has again fallen to a point lower than ever before reported, being about 7% below par.

Platinum—The market is still rather unsettled, but is inclined to be stronger. There is no quotable change, however. Dealers ask $39@41 per oz. for refined platinum, and $45@48 for hard metal, according to grade.

Silver—The market has ruled steady the past week with upward tendency in London due to limited supplies. Market closes steady at 23⅞d.; the New York price has been seriously affected by the fall in sterling exchange from $4.65 to $4.51 during the week.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—Aug. 28

The base price paid this week for 60% zinc ore was $65@75 per ton. The base price paid for 80% lead ore was $50 per ton.

SHIPMENTS, WEEK ENDED AUG. 28

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	3,754,230	380,000	628,500
Year	125,276,440	4,463,160	18,728,710

Shipped during week to separating plants, 4,823,900 lb. zinc ore.

JOPLIN, MO.—Aug. 28

Blende, high price $87.50; base price per ton of 60% zinc, premium ore, $86; medium, $85@80; lower grades down to $75, and early purchases at $70. Calamine, base per ton 40% zinc, $70@48; average, all grades of zinc, $74.67 per ton. Lead, high price $46.50; base price $45 per ton of 80% metal content; average, all grades of lead, $44.95 per ton.

SHIPMENTS WEEK ENDED AUG. 28

	Blende	Calamine	Lead	Values
Totals this week.	9,835,550	457,020	1,993,150	$429,050
Totals this year..	374,792,280	30,221,580	58,216,880	16,377,310

Blende value, the week, $374,700; eight months, $14,177,870.
Calamine value, the week, $9550; eight months, $660,590.
Lead value, the week, $44,800; eight months, $1,538,850.

A few cars of zinc ore were picked up early in the week around $70 base, but week-end purchases were largely above $80 for all grades sought. The American Metal Co. has been a very active purchasing agent for four weeks, and reports have been received here that this company has purchased all available ore in Wisconsin. The upward market is welcomed heartily, and producers are greatly encouraged with hopes of a further advance, at least in premium ores.

Iron Trade Review

NEW YORK—Sept. 1

Increased and increasing activity is manifest everywhere in the iron and steel trades. Mills are full and are beginning to fall behind on deliveries in a way that has not been seen for more than a year. Increased home orders are helping the munition or export orders to fill up the mills.

Pig iron markets are showing much strength and gains everywhere. Orders are coming in and prices are advancing steadily. The blowing in of additional furnaces has checked the advance to some extent, but the higher prices already made are being generally held, especially on Southern iron.

PITTSBURGH—Aug. 31

The booking of actual shipping orders in the steel trade in August has covered fully as large a tonnage as in July, while the export bookings have been heavier. The domestic business has been confined largely to specifications on old contracts, on which the buyers had a decided advantage as compared with prices currently quoted. The mills have no difficulty in finding business enough to operate at capacity, and are indeed falling behind in deliveries in nearly all lines, in some cases because the finishing departments are crowded and in other cases because the crude steel is scarce.

It is the general expectation that strictly new buying in steel products will be much heavier in September than it has been in August and in some quarters an actual famine in steel is predicted. It is understood that the railroads are considering the steel situation very carefully, realizing the possibility of not being able to secure deliveries desired in 1916, and at satisfactory prices, if they do not buy in time. The situation as to rails is particularly interesting, as so many rail mills are now rolling large steel rounds for shrapnel.

A part of the demand for steel in the past two or three months has been due to the desire of jobbers and manufacturing consumers to replenish their stocks, which had naturally been reduced to a very low level when mill deliveries were prompt. This extra demand of course is only temporary, and it may require a greater increase in general industrial activity than is now generally apprehended to maintain pressure upon the steel mills for steel.

Steel prices have continued to strengthen. The 1.30c. quotation on bars has disappeared, making the market 1.35c., while structural shapes and plates are trending to the same level. Blue annealed sheets have advanced $2 a ton to 1.50c. while black sheets are firmer.

Pig Iron—The American Steel Foundries has bought 10,000 tons basic iron from two middle interests for delivery to Sharon and Alliance over the balance of the year, on the basis of $14.50 at Valley furnaces, firmly establishing the market at this advanced figure and disposing some sellers to quote $14.75 or $15. A sale of 3000 tons of bessemer has been made at $15.50, Valley, for export early in September. The odd lots of malleable and foundry that were available at $14 at furnace have disappeared and the market is firm at $14.50 for this year's delivery, with $15 asked for the first half of next year. There remain very considerable stocks of basic iron, held largely in middle hands and there is some comment on the facility with which pig iron prices have been advancing when the sales have been light. The Jones & Laughlin Steel Co. recently bought 25,000 tons of basic iron from E. W. Mudge & Co., at a price below the present market. We quote: Bessemer, $15.50; basic, malleable and No. 2 foundry, $14.50@15; forge, $14.25@14.75, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

COKE

Coal and Coke Tonnage of Pennsylvania R.R. lines east of Pittsburgh and Erie, seven months ended July 31, in short tons:

	1914	1915	Changes
Anthracite	6 241,171	6,076,487	D. 164,684
Bituminous	25,739,730	23,929,923	D. 1,809,807
Coke	6,039,016	6,090,263	I 51,247
Totals	38,019,917	36,096,673	D. 1,923,244

The total decrease this year was 5.1%. The July tonnage was 5,412,510 tons, showing a gain of 122,929 tons over last year.

Chemicals

NEW YORK—Sept. 1

Conditions in the general market show no special changes from last week, the position being rather strong.

Arsenic—Business is moderate but the market is firm. Prices are about $3.50 per 100 lb. for carload lots, and up to $4 per 100 lb. for smaller parcels.

Copper Sulphate—Trade is fair but without change in prices, $7.25 per 100 lb. being asked for large lots and $7.50 for smaller parcels.

Nitrate of Soda—The market is rather stiff, conditions remaining unchanged. September deliveries are quoted at 2.42½c. per lb.; while 2.45c. is named for futures.

Pyrites—Imports at Baltimore for the week included 4094 tons pyrites from Huelva, Spain.

Assessments

Company	Delinqe	Sale	Amt.
Belmont, Ida	Aug. 10	Sept. 10	$0.003
Blue Bell, Ida., (post.)	.....	Aug. 30	0.003
Bonanza Con., Utah	Sept. 15	Oct. 6	0.015
Buffalo, Mout	July 22	Sept. 10	0.003
Bullion, Ida	Aug. 30	Sept. 25	0.005
Cedar Creek, Ida	Aug. 28	Sept. 29	0.005
Comet, Ida	Aug. 30	Sept. 30	0.0005
Copper Chief, Ida	Aug. 30	Sept. 25	0.005
East Coeur d'Alene, Ida	Aug. 9	Sept. 9	0.001
East Hercules Ext., Wash	Aug. 10	Sept. 10	0.0015
Gethin Le Roy, Utah	Sept. 25	Oct. 13	0.01
Great Bend, Nev	Sept. 10	Oct. 10	0.01
Hancock Cons., Mich	Sept. 1	.....	1.00
Hancock Cons., Mich	Jan. 3	.....	1.00
Happy Day, Ida	Aug. 26	Sept. 30	0.0025
Hector, Ida	Sept. 4	Oct. 4	0.005
Hennessy-Burns, Ida	Aug. 20	Sept. 24	0.005
Honolulu, Ida	Aug. 24	Sept. 13	0.0035
Idaho Los Angeles, Ida	Sept. 3	Sept. 25	0.005
Idaho Montana, Ida	Sept. 3	Sept. 25	0.001
Idaho Nevada, Ida	Sept. 7	Oct. 1	0.002
Imperial, Ida	Aug. 31	Oct. 1	0.005
Keweenaw, Mich	Sept. 1	.....	1.00
Laclede, Ida	Sept. 3	Sept. 27	0.003
Lake Superior & West., Ariz.	.....	.....	0.02
Liquidator, Ida	Aug. 28	Sept. 28	0.003
Lucky-Calumet, Ida	Aug. 27	Sept. 27	0.005
MacNamara, Nev	Aug. 23	Sept. 13	0.02
New Arcadian, Mich	Dec. 1	.....	0.50
New Baltic, Mich	Jan. 15	.....	0.50
New Quincy, Utah	Sept. 2	Sept. 23	0.01
Old Veteran, Ida	Sept. 2	Sept. 30	0.002
Oom Paul, Ida	Aug. 28	Sept. 28	0.01
Oom Paul Con, Ida	Aug. 30	Oct. 4	0.01
Oreano, Ida	Aug. 2	Sept. 2	0.0015
Phoenix, Mich	Sept. 1	.....	1.00
Phoenix, Mich	Jan. 1	.....	1.00
Revelator, Utah	Oct. 4	Oct. 25	0.00½
Royal, Ida	Sept. 1	Oct. 1	0.001
Sandstorm Kendall, Nev	Aug. 23	Sept. 27	0.01
Selma Utah	Sept. 8	Sept. 25	0.005
Smuggler, Utah	Aug. 17	Sept. 10	0.005
Snowshoe, Ida	Aug. 26	Sept. 27	0.005
Sonora, Ida	July 23	Aug. 31	0.004
Springfield, Ida	July 30	Aug. 30	0.002
Sunset Dev., Wash	Aug. 25	Sept. 18	0.002
Syndicate, Utah	Sept. 11	Oct. 2	0.001
Tonopah Bonanza, Nev	Sept. 13	Oct. 11	0.01
Tonopah Midway, Nev	Aug. 18	Sept. 18	0.01
Union Cons., Nev	Aug. 24	Sept. 14	0.05
White Caps, Nev	Aug. 14	Sept. 18	0.015

Stock Quotations

New York sales at auction: 800 Mines Co. of Amer., 20c.; 3500 Cobalt Central and 50 Nevada-Utah M. & S., $3 lot; 424,-750 Ely-Giroux Copper, $500 lot.

COLO. SPRINGS	Aug. 30	SALT LAKE	Aug. 30
Name of Comp.	Bid.	Name of Comp.	Bid.
Acacia	.02½	Beck Tunnel	.05½
Cripple Cr'k Con	.009	Black Jack	.09½
C. K. & N	.02	Colorado Mining	.05
Doctor Jack Pot	.09½	Crown Point	.01
Elkton Con	.27½	Daly-Judge	6.00
El Paso	.80	Gold Chain	.16
Findlay	.03½	Grand Central	.50
Gold Dollar	.02	Iron Blossom	.66
Gold Sovereign	.02	Little Bell	‡.10
Golden Cycle	1.78½	Lower Mammoth	.03
Isabella	.15½	Mason Valley	2.00
Jack Pot	.06½	May Day	.16½
Jennie Sample	‡.02	Opohongo	‡.00½
Jerry Johnson	.04½	Prince Con	.67
Levington	.005	Seven Troughs	.01½
Mary McKinney	.37½	Silver King Coal'n	3.37
Pharmacist	.008	Silver King Con	2.02½
Portland	1.47	Sioux Con	.01½
Raven B. H	.02	Uncle Sam	.06½
Vindicator	1.57½	Yankee	.24

TORONTO	Aug 30		
Bailey	.04	Dome Exten	.18
Coniagas	4.00	Foley O'Brien	.27
Peterson Lake	.19	Hollinger	24 00
Right of Way	‡.02	Imperial	.05
Seneca Superior	.78	Jupiter	.11½
Silver Queen	‡.01	McIntyre	.48
T. & Hudson Bay	20 00	Pearl Lake	‡.00½
Timiskaming	.32	Porcu. Crown	.70
Wettlaufer-Lor	.04	Preston E. D	.05
Dome Mines	21 50	Rea	‡.10

SAN FRANCISCO	Aug. 30		
Comstock Stocks		Misc. Nev. & Cal	
Alta	.06	Belmont	3.80
Andes	.10	Jim Butler	.80
Best & Belcher	.08	Lone Star	.03
Caledonia	.80	MacNamara	.02
Challenge Con	.09	Midway	.10
Chollar	.04	Mont.-Tonopah	.25
Confidence	.17	North Star	.10
Con. Virginia	.19	Rescue Eula	.06
Gould & Curry	.05	West End Con	.57
Hale & Norcross	.07	Atlanta	.30
Julia	.02	Booth	.42
Mexican	.57	C.O.D. Con	.04
Occidental	.79	Comb. Frac	.08
Ophir	.43	D'field Daisy	.03
Overman	.10	Jumbo Extension	1.50
Potosi	.03	Pitts.-Silver Peak	.06
Savage	.09	Round Mountain	.39
Sierra Nevada	.25	Sandstorm Kendall	.06
Union Con	.58	Silver Pick	.08
Yellow Jacket	.17	Central Eureka	.14

N. Y. EXCH.	Aug. 03	BOSTON EXCH	Aug. 30
Name of Comp.	Clg.	Name of Comp.	Clg.
Am.Sm.&Ref.,com	80½	Adventure	1½
Am. Sm. & Ref., pf.	107	Ahmeek	398
Am. Sm. Sec., pf. B.	80	Alaska Gold M	33½
Anaconda	73½	Algomah	2½
Batopilas Min	1½	Allouez	54½
Bethlehem Steel	291	Am. Zinc	55½
Bethlehem Steel, pf.	140½	Ariz. Com., ctfs	8⅞
Chino	46⅛	Bonanza	.35
Colo. Fuel & Iron	42½	Butte-Balaklava	4½
Crucible Steel	75⅛	Butte & Superior	66½
Federal M. & S., pf.	49	Calumet & Ariz	64
Great Nor., ore., ctf.	42½	Calumet & Hecla	560
Guggen. Exp	67	Centennial	19
Homestake	117	Cliff	‡.90
Inspiration Con	36	Copper Range	55½
Mex. Petroleum	84⅛	Daly West	3
Miami Copper	26½	East Butte	13
Nat'l Lead, com	65	Franklin	9½
National Lead, pf	112	Granby	86
Nev. Consol	15	Hancock	16½
Ontario Min	3½	Hedley	26
Quicksilver	3½	Helvetia	.25
Ray Con	23½	Indiana	5
Republic I&S, com	43½	Island Cr'k, com	48
Republic I&S, pf	101½	Island Cr'k, pfd	89½
SlossSheffi'd, com	53⅛	Isle Royale	26½
Tennessee Copper	56½	Keweenaw	1½
Utah Copper	68	Lake	14½
U. S. Steel, com	75⅛	La Salle	5
U. S. Steel, pf	112½	Mass	10½
		Mayflower	3½
N. Y. CURB	Aug. 30	Michigan	2½
Alask'a Juneau	13½	Mohawk	72½
Alta Con	.42	New Arcadian	10½
Beaver Con	.28	North Butte	30½
Big Four	.05	North Lake	1½
Blue Bell	.02	Ojibway	1½
Braden Copper	8⅛	Old Colony	‡2½
Buffalo Mines	⅛	Old Dominion	54
Can. Cop. Corpn	‡¼	Osceola	83
Cashboy	.05	Quincy	85
Chambers Ferland	.12	Santa Fe	2⅞
Chile Cop	19	Shannon	7½
Con. Ariz. Sm	⅛	Shattuck-Ariz	25⅝
Con. Coppermines	1½	Superior	27½
Con. Nev.-Utah	1/16	Superior & Bost	2½
Dia. Black B	.03	Tamarack	52½
Florence	.45	Trinity	3⅛
Goldfield Con	1½	Tuolumne	.47
Goldfield Merger	.19	U. S. Smelting	41
Greene Cananea	40	U. S. Smelt'g, pf	46½
International Nickel	182	Utah Apex	3½
Kennecott Cop	52½	Utah Con	13
Kerr Lake	3⅛	Victoria	2½
La Rose	1/16	Winona	3½
Magma	14½	Wolverine	63½
McKinley-Dar-Sa	.25	Wyandot	1⅛
Mines of Am	‡2⅛		
Nevada Hills	.20	BOSTON CURB	Aug. 30
New Utah Bingham	3⅛	Alvarado	.50
Nipissing Mines	5⅛	Bingham Mines	8⅛
Oro	.07	Boston Ely	.23
St. Joseph Lead	13½	Butte & Lon'n Dev	.35
South Utah	.16	Calaveras	1⅛
Stand'd Oil of N.J.	448	Calumet-Corbin	.04
Standard S. L	1 1/16	Chief Con	.97
Stewart	1 1/16	Corbin	‡.50
Success	1 3/16	Cortez	.45
Tonopah	5⅛	Crown Reserve	.32
Tonopah Ex	2 1/16	Davis-Daly	1½
Tonopah Merger	.35	Eagle & Blue Bell	1⅛
Tribullion	1/16	First Nat. Cop	2⅛
Tularosa	‡1/16	Houghton Copper	3
Yukon Gold	2½	Iron Cap Cop., pf	5
		Majestic	.52
LONDON	Aug. 19	Mexican Metals	.23
Alaska Tre'dwell	£7 1s 3d	Nevada-Douglas	.60
Burma Corp	1 13 9	New Baltic	3
Cam & Motor	0 12 6	Ohio Copper	.10
Camp Bird	0 5 0	Oneco	1
El Oro	0 7 6	Raven Copper	.12
Esperanza	0 7 9	Smokey Dev	.15
Mexico Mines	3 12 6	So. Lake	6½
Nechi, pfd	0 12 0	Tonopah Victor	.26
Oroville	0 15 0	Trethewey	.11
Santa Gert'dis	0 7 6	United Verde Ext	5⅛
Tomboy	1 0 0		
Tough Oakes	0 6 6	‡Last Quotations.	

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.490	58.519	50.250	27.416	26.958	23.709
May	60.361	58.175	49.915	27.825	26.704	23.570
June	58.990	56.471	49.034	27.199	25.948	23.267
July	58.721	54.678	47.519	27.074	25.219	22.597
August	59.293	54.344	47.163	27.335	25.979	22.780
September	60.640	53.290	.....	27.986	24.260	.....
October	60.793	50.654	.....	28.083	23.199	.....
November	58.995	49.082	.....	27.263	22.703	.....
December	57.760	49.375	.....	26.720	22.900	.....
Year	59.791	54.811	.....	27.576	25.314	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York Electrolytic		London Standard		London Best Selected	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.497	14.394	65.259	63.494	70.188	*
March	14.311	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.069	69.313	*
May	13.99	18.506	63.182	77.600	67.786	*
June	13.603	19.477	61.336	82.574	66.274	95.333
July	13.223	18.796	60.540	76.011	64.955	91.409
August	*	16.941	‡	68.673	‡	82.333
September	*	.....	‡	.....	‡	.....
October	*	.....	‡	.....	‡	.....
November	11.739	.....	53.227	.....	‡	.....
December	12.801	.....	56.841	.....	*	.....
Year	.....	.....	.....	.....	.....	.....

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47.884	163.963	166.225
May	33.360	38.790	150.702	162.675
June	30.577	40.288	138.321	167.636
July	31.707	37.423	142.517	167.080
August	*	34.389	‡	151.440
September	32.675	.....	‡	.....
October	30.284	.....	‡	.....
November	33.304	.....	[illegible]9.391	.....
December	33.601	.....	147.102	.....
Av. year	34.301	.....	.....	.....

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	5.932	3.810	5.836	19.411	25.170
July	3.891	5.659	3.758	5.531	19.051	24.611
August	3.877	4.656	3.715	4.520	‡	21.946
September	3.828	.....	3.658	.....	‡	.....
October	3.528	.....	3.384	.....	‡	.....
November	3.683	.....	3.585	.....	18.500	.....
December	3.800	.....	3.662	.....	19.097	.....
Year	3.862	.....	3.737	.....	.....	.....

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21.569	49.888
May	5.074	14.781	4.924	14.610	21.393	68.100
June	5.000	21.208	4.850	21.038	21.345	100.614
July	4.920	19.026	4.770	18.856	21.568	97.250
August	5.568	12.781	5.418	12.611	‡	67.786
September	5.380	.....	5.230	.....	‡	.....
October	4.909	.....	4.750	.....	‡	.....
November	5.112	.....	4.962	.....	25.016	.....
December	5.592	.....	5.430	.....	27.369	.....
Year	5.213	.....	5.061	.....	.....	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported, ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07	14.55	13.94	13.45	14.10	13.95
April	14.90	14.55	13.90	13.45	14.13	13.95
May	4.90	14.61	13.90	13.60	14.27	13.83
June	14.90	14.70	13.90	13.67	13.96	13.77
July	14.90	14.94	13.90	13.91	13.90	13.68
August	14.90	16.10	13.90	15.08	14.08	14.75
September	14.90	.....	13.90	.....	14.03	.....
October	14.84	.....	13.75	.....	13.97	.....
November	14.59	.....	13.43	.....	13.83	.....
December	14.70	.....	13.45	.....	13.83	.....
Year	$14.88	.....	$13.78	.....	$14.01	.....

The Mining Index

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print) in the original language for the price quoted. Where no price is quoted, the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for $1, 33 for $5, and 100 for $15. When remittances are made in even dollars, we will return the excess over an order in coupons, if so requested.

COPPER

1698—CHILE—Bosquejo del Estado Actual de la Industria Minera del Cobre en el Estranjero i en Chile. J. G. Matta. (Bol. Soc. Nac. de Mineria. Mar. and Apr., 1915; 20 pp., illus.) To be continued.

1699—EFFICIENCY ENGINEERING in the Copper Country. P. B. McDonald. (Min. and Sci. Press, July 24, 1915; 1½ pp.) 20c.

1700—HYDRO-ELECTROLYTIC TREATMENT of Copper Ores. Robert Rhea Goodrich. (Am. Electrochem. Soc., Apr. 18, 1914; 127 pp., illus.)

1701—LEACHING—Roasting and Leaching Concentrator Slimes Tailings. Lawrence Addicks. (Bull. A. I. M. E., Aug., 1915; 13½ pp., illus.) 40c.

1702—NEW MEXICO—Tyrone District, Grant County, New Mexico. Clifford C. Blood. (Min. and Eng. Wld., Aug. 21, 1915; 2¾ pp., illus.) 20c.

1703—ORE TREATMENT—Ueber die Verarbeitung kupferarmer, kieselsäure reicher, Kalk und Magnesia enthaltender Kupfererze. Binder. (Chem.-Ztg., May 15, 1915; ½ p.) On the treatment of copper ores poor in copper, but rich in silica which contain also lime and magnesia.

1704—REFINING—The Sources of Impurities in Cathode Copper. Lawrence Addicks. (Advance copy, Proc. Am. Electrochem. Soc., Oct., 1914; 11 pp., illus.)

1705—SLAG-SETTLER—Granby Tapered Settler. Frank E. Lathe. (Eng. and Min. Journ., Aug. 14, 1915; ½ p., illus.) 20c.

1706—SLAGS—Metal Loss in Copper Slags. Frank E. Lathe. (Eng. and Min. Journ., Aug. 7, 14 and 21, 1915; 11¾ pp., illus.) 60c.

GOLD AND SILVER—GEOLOGY

1707—KALGOORLIE—The Geology of Kalgoorlie. C. O. G. Larcombe. (Min. and Sci. Press, Aug. 14, 1915; 8 pp., illus.) 20c.

1708—ONTARIO—The Ordovician Rocks of Lake Timiskaming. M. Y. Williams. (Can. Dept. of Mines, Geol. Surv., Museum Bull. No. 17; 9 pp.)

GOLD DREDGING, PLACER MINING, ETC.

1709—ALASKA—Bagley Scraper for Gravel Mining in Alaska. Lewis H. Eddy. (Eng. and Min. Journ., Aug. 14, 1915; 1½ pp., illus.) 20c.

1710—CANADA—Rocker and Grizzly Mining on the North Saskatchewan. J. A. Macdonald. (Eng. and Min. Journ., July 31, 1915; 1¼ pp., illus.) 20c.

1711—OREGON—Hydraulicking at Waldo, Ore. W. H. Wright. (Eng. and Min. Journ., Aug. 7, 1915; 3¾ pp., illus.) 20c.

1712—SIBERIA—The Gold Mines of the Lena. C. W. Purington. (Min. Mag., June, 1915; 9½ pp., illus.) 60c.

1713—THAWING METHODS at Fairbanks. Hubert I. Ellis. (Eng. and Min. Journ., July 3, 1915; 5¼ pp., illus.) 20c.

GOLD AND SILVER—CYANIDING

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